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Date: 11/24/2014 03:59 PM
Subject: FW: Phillips 66 - Rail Project - Comments on RDEIR
(SCH#2013071028)

Hi Murry,

Please find attached our comments on the Revised Draft EIR for the Phillips 66 Rail Project.

Thank you,

Greg

Greg McGowan | Principal Ecologist | greg.mcgowan@arcadis-us.com

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(See attached file: Phillips 66 RDEIR Comments Package 11-24-14.pdf)

Phillips 66 Company Rail Project
Revised Public Draft Environmental Impact Report and
Vertical Coastal Access Project Assessment
SCH# 2013071028

Phillips 66 Comment Summary Table

	#	Page Number	Paragraph, Table or Figure	Subject of Comment (Specific Item or Language)	Comment/Explanation of Issue	Recommended Action
P66-01	1	General	General	Feasibility	Under CEQA's Guidelines, an EIR must describe the "feasible measures which could minimize significant adverse impacts . . . ." 14 C.C.R. § 15126.4(a)(1). A mitigation measure is "feasible" if it is "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors." Pub. Res. § 21061.1; 14 C.C.R. § 15364; see also Santa Clarita Org. for Planning the Env't v. City of Santa Clarita, 197 Cal.App.4th 1042, 1053-59 (Cal. Ct. App. 2011) (holding sufficient evidence supported a city's finding that complete mitigation of a project's impact on climate change was infeasible).	Edit mitigation measures as describe based on appropriate standards of feasibility.
P66-02	2	ES-1	Second Paragraph	Coastal Access	This paragraph does not accurately describe the condition of approval for the Throughput Increase Project relating to coastal access. The paragraph should be revised to be consistent with the condition, which is quoted in full on page 9-4 of the Revised Draft EIR. Corresponding revisions should be made to pages 1-9, 4.8-2, 9-1 ¶ 3, and Appendix G page G-5. Specifically, page ES-1 states: "Phillips 66 was recently required to provide a vertical public right of coastal access at the SMR site as a condition of approval of the Phillips 66 Throughput Increase Project (approved by the County Board of Supervisors in March 2013)." Condition 17, the relevant condition on the Throughput Increase Project, does not require vertical coastal access. Rather, as shown on page 9-4, Condition 17 requires compliance with Section 23.04.420 of the Coastal Zone Land Use Ordinance. That section, in turn, requires certain access	Edit the description of the condition of approval as described throughout the document. Revised discussions of coastal policy application accordingly.

Phillips 66 Comment Summary Table

#	Page Number	Paragraph, Table or Figure	Subject of Comment (Specific Item or Language)	Comment/Explanation of Issue	Recommended Action
P66-02 cont				be provided "except where … access would be inconsistent with public safety, military security needs or the protection of fragile coastal resources…" At the Planning Commission hearing on the Throughput Increase Project on December 13, 2012, Jean St. Martin, counsel for Phillips 66, pointed out that because the condition required compliance with Section 23.04.420, the condition could be satisfied either through an offer to dedicate public access or through a showing that one or more of the exemptions applies. Planning Commissioners Murphy and Irving queried County Counsel on this point, and ultimately concurred in this interpretation, and the Commission approved the project based on that interpretation. See video recording of Planning Commission meeting of December 13, 2012, Agenda Item 2, available directly by the link below: http://slocounty.granicus.com/MediaPlayer.php?view_id=31&clip_id=1401 • Agenda Item 2 is introduced approximately 59 minutes and 30 seconds into the video. • Ms. St. Martin's comments begin at 1 hour, 28 minutes, and 25 seconds. • The Commissioner's discuss coastal access starting at 1 hour and 47 minutes.	

Phillips 66 Comment Summary Table

	#	Page Number	Paragraph, Table or Figure	Subject of Comment (Specific Item or Language)	Comment/Explanation of Issue	Recommended Action
P66-02 cont					The County has not yet determined whether an exemption applies, however the information in Revised Draft EIR Section 9, Coastal Access, shows that providing access across the SMR property would have significant impacts on threatened and endangered species and other sensitive biological resources, and that it presents serious public safety concerns. Accordingly, the Revised Draft EIR demonstrates that two exemptions apply. Finally, this paragraph should clarify that Phillips 66 has not proposed a "Coastal Access Project". Based on the information in the Revised Draft EIR, these comments, and the Coastal Access Feasibility Review (ARCADIS, August 2013) cited at page 9-72, Phillips 66 anticipates that County will conclude that it is exempt under Section 23.04.420 (c).	
P66-03	3	ES-2	Figure ES-1	Property Lines	Figure ES-1 depicts the Santa Maria Refinery property as a single expanse of contiguous parcels. This is not accurate. As shown on the figure, the Union Pacific Railroad property bisects the refinery area from north to south. The refinery property lies on either side of the railroad but does not include the railroad corridor itself. Phillips 66 does not own or control the land on which the railroad is built. In 1891, the then-owner, Henry Bosse, sold the land to the Southern Pacific Railroad Company for purposes of construction and operation of a railroad line and related infrastructure. A copy of the 1891 deed is included as Attachment A to these comments. Revised Draft EIR page 9-3 acknowledges	Figures should be revised to show the refinery as two blocks of land lying on either side of the railroad property. If the scale of the figure does not allow this, then text should be added that explains this situation.

Phillips 66 Comment Summary Table

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P66-03 cont					that Phillips 66 cannot provide access to the shore because it does not own uninterrupted property from Highway 1 to the shore, and separate access would be required across the railroad property. Accordingly, Figure ES-1 should be revised to show the refinery as two blocks of land lying on either side of the railroad property. If the scale of the figure does not allow this, then text should be added on page ES-1 that explains this situation. Phillips 66 surmises that the property underlying the railroad is currently owned in fee by Union Pacific Railroad; however, we do not have sufficient information on the railroad property (e.g., parcel numbers) to be able to research title. Corresponding revisions should be made to figures throughout the Revised Draft EIR, including but not limited to Figures ES-2, ES-4, 1-2, 1-3, 1-4, 2-1, 2-3, and 9-1, and/or the associated text.	
P66-04	4	ES-5 1-4 2-22	3rd Paragraph 4th Paragraph Section 2.5-2nd Paragraph	"…90 feet…"	The tank cars and buffer cars are both 60 feet long. Only the locomotives are 90 feet long.	Edit accordingly
P66-05	5	ES-18	Last Paragraph	Impacts of public access	This paragraph describes what would happen at the western edge of a public access route across Phillips 66 property, where it meets the boundary of the ODSVRA. As noted at page 9-11 of the Revised Draft EIR, at this point, people would still be about 7,500 feet –	The referenced assumption should be deleted and replaced with more realistic assumptions of public access straying from designated routes.

Phillips 66 Comment Summary Table

	#	Page Number	Paragraph, Table or Figure	Subject of Comment (Specific Item or Language)	Comment/Explanation of Issue	Recommended Action
P66-05 cont					almost 1 ½ miles – from the coast. This paragraph states, "It is assumed that users would continue to follow the existing service road to the beach and not short-cut through vegetated dune areas and the large dune wetland area immediately west of the SMR property." Elsewhere, the Revised Draft EIR acknowledges that people may cause significant environmental impacts by straying from a designated coastal access route across the Phillips 66 property. See, e.g., Section 9, discussing impacts to sensitive wildlife species (page 9-38), wetlands (page 9-39), sensitive biological resources (page 9-41), and cultural resources (page 9-43), all due to people wandering off the designated route and accidentally damaging or intentionally vandalizing sensitive resources. There is no basis to assume people would behave differently and always adhere to the path once they enter the ODSVRA.	
P66-06	6	2-8	Section 2.3.1, 2nd Paragraph	"….five parallel tracks, each long enough to hold an entire train…."	Track 1 is the only track that in no way could hold an entire train as it merges with Track 2 about mid-way. The other tracks could almost hold entire trains but really only the combination of Track 1 & 2, Track 3, and Track 5 can hold a full train. Thus, five trains could not feasibly be on site at once; only 2 trains are really able to be stored and moved on site.	Edit accordingly
P66-07	7	2-11	Last Paragraph, Last Sentence	"…(Tracks 1/2 and Track 32)…"	Track 32 should be Track 3.	Edit accordingly
P66-08	8	2-14	5th Paragraph, 1st and 4th	"The air eliminators……"	One (1) Air Eliminator.	Edit accordingly

Phillips 66 Comment Summary Table

	#	Page Number	Paragraph, Table or Figure	Subject of Comment (Specific Item or Language)	Comment/Explanation of Issue	Recommended Action
			Sentences			
P66-09	9	2-18	Section 2.3.10	"…with a vacuum truck."	It will take multiple vacuum trucks.	Edit accordingly
P66-10	10	2-27	Number 3 and 5	Third Locomotive	The third locomotive is at the back of the train incoming (#3) but then it's at the head of the train outgoing (#5). This is combining two different operations. If the configuration is 2 Locos, 2 Buffers, 80 Railcars, 1 Loco, it should leave the same way; not 3 Locos, 2 buffers, 80 Railcars.	Edit accordingly
P66-11	11	2-29	Table 2.5, Note 6.	Assumes the third locomotive idles 10% …	We have considered that according to the way that the locomotive engines work, that percentage could be more than that.	Edit accordingly
P66-12	12	2-31	Fourth	Measurement of Tank Vapor Pressure	The text states that naptha and gas oil tanks have permit limits on vapor pressure. That is partially correct. The gas oil tanks have permit limits on vapor pressure; however the naptha tanks are under vapor recovery.	Edit accordingly for clarification
P66-13	13	2-31; Section 2.6	Crude Descriptions	Mention of heavy stock crudes	There is prior mention of no Bakken crude and there is mention that the facility processes heavy stock crudes, but nowhere is it stated Bakken is a lighter crude. This may prevent comments later.	Edit accordingly to state that Bakken crude oil is a light crude oil.
P66-14	14	4.3-15	Paragraphs 5-6	Units of GHGs (MMTCE or MMTCO2e)	The report uses the term, million metric tons carbon equivalent (MMTCE). However, the appropriate units for the values reported in the document should be million metric tons carbon DIOXIDE equivalent (MMTCO2e). The difference between carbon (MW=12) and carbon dioxide (MW=44) results in misreporting the values by a factor of 3.7.	Replace MMTCE with MMTCO2e.
P66-15	15	4.3-23, 4.3-64, 4.3-65	Figures 4.3-4, 4.3-6, and 4.3-7	Risk values	As noted, the cancer health risk isopleths shown in the figures are based on the OEHHA adjusted factors. The proposed OEHHA adjustment factors are still in draft form	The most accurate and informative approach would be to show the results of the current and the proposed future

Phillips 66 Comment Summary Table

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P66-15 cont					and results in increases in cancer risks by approximately 1.8. The presentation of the figures only with the OEHHA adjusted factors provides the reader with an exaggerated level of potential risk.	calculations. Add figures to show cancer risks as they are currently calculated. Use footnotes to clarify the different standards being employed and the use of draft OEHHA guidance.
P66-16	16	4.3-42	Table 4.3.12	Mitigated DPM daily significance	The mitigated daily DPM construction emissions were calculated to be 5.6 lbs/day, (see Appendix A). Table 4.3.12 incorrectly reports the value as 4.7 lbs/day.	Revise the table with the correct emissions.
P66-17	17	4.3-42	Table 4.3.12	Construction mitigation measures	CalEEMod runs did not include mitigation measure AQ-1d which requires all construction equipment greater than 100 hp be equipped with Level 3 DPFs. Application of this mitigation measure would reduce DPM emissions from the applicable equipment by 85 percent.	Revise the CalEEMod runs to include all mitigation measures listed in the EIR.
P66-18	18	4.3-54	Table 4.3.19	Explanation of calculations	Table 4.3.19 presents emissions past the Roseville and Colton rail yards. The notes at the bottom of the table indicate detailed emission calculations are provided in Appendix B. However, it does not appear that Appendix B has these emission calculations.	Detailed emission calculations for these scenarios should be included in Appendix B.
P66-19	19	4.3-54	Table 4.3.19	Roseville to Washington Route	For the second route through Roseville which is labeled as "Roseville to Washington", it does not appear to include travel through Oregon.	The route should either add emissions associated with travel with Oregon or the route should be renamed Roseville to Oregon.
P66-20	20	4.4-27	Mitigation BIO-1	Preconstruction Surveys	This mitigation measure is aimed potential impacts of the Project to the state and federally listed plant species Nipomo Mesa Lupine. The measure requires that a "focused survey" be conducted "during a normal rainfall season" prior to initiation of project activities to determine the presence or absence of that plant species within the Project Site. California has suffered severe drought	Revise measure to require a preconstruction survey by a qualified biologist prior to construction.

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	#	Page Number	Paragraph, Table or Figure	Subject of Comment (Specific Item or Language)	Comment/Explanation of Issue	Recommended Action
P66-20 cont					conditions for the past two years, as summarized by the two drought declarations that California's Governor Jerry Brown issued on January 17 and April 24, 2014. Given the current drought, it is unclear when California will again enjoy a "normal rainfall season," and if it will enjoy such a season before commencement of the proposed construction activities. Therefore, this mitigation measure may be infeasible in a "reasonable period of time", and may cause indefinite delay in commencement of the project.	
P66-21	21	4.7-59	Second Paragraph "Quantitative Risk Assessment Results"	Risk assessment results	Figure reference to 4.7-4 is erroneous	Change reference to Figure 4.7-5
P66-22	22	4.7-60	Figure 4.7-5	Context	This figure should contain in its title or in a footnote that the risk profiles shown reflect a worst-cast assumption that all 250 trains pre year utilize the same track.	Change title or insert footnote.
P66-23	23	4.7-61	6th Paragraph	Reference	Figure reference to Figure 2.7-5 is erroneous and should reference 4.7-5	Change reference to Figure 4.7-5
P66-24	24	4.7-62	Mitigation HM-2a	Tank Car Design	This mitigation measure would require the Project to use only "rail cars designed to FRA, July 23, 2014 Proposed Rulemaking Option 1: PHMSA and FRA Designed Tank Car as listed in Table 4.7.6" ("Option 1 Tank Cars") to unload crude oil at the SMR. The mitigation measure should be revised for several reasons. First, it is preempted by the ICCTA. Second, this mitigation measure is premature, as the Pipeline and Hazardous Materials	The mitigation measure should be deleted because it is infeasible and preempted.

Phillips 66 Comment Summary Table

P66-24 cont

#	Page Number	Paragraph, Table or Figure	Subject of Comment (Specific Item or Language)	Comment/Explanation of Issue	Recommended Action
				Safety Administration ("PHMSA") itself has not yet settled on the appropriate technology to require. Third, the measure is infeasible due to unavailability of the specified equipment. On August 1, 2014, PHMSA published its Notice of Proposed Rulemaking ("NPRM") to propose changes to specifications for rail tank cars authorized to transport crude oil and ethanol. 79 Fed. Reg. 45016 (Aug. 1. 2014). The NPRM set forth three possible options for enhanced car standards: (1) the Option 1 Tank Cars, as required under this mitigation measure; (2) the Option 2 Tank Cars, as recommended by the Association of American Railroads; and (3) the Option 3 Tank Cars, enhanced jacketed CPC-1232 tank cars. Id. at p. 45052. This mitigation measure is premature, as the PHMSA itself has not yet adopted this proposed rule as a binding regulation, and there is no indication that the PHMSA will indeed adopt this option. The PHMSA solicited comments on three options because it was aware that tank cars represent a substantial investment, and it believed it did not yet have sufficient information to make a decision. It is unknown at this time which option the PHMSA will adopt and impose on rail transporters of crude oil. If the PHMSA does not adopt Option 1, those cars may not even be constructed. Regardless, the tank cars that will deliver crude to the SMR will be subject to whichever option the PHMSA ultimately adopts. The County does not have extensive knowledge and	

Phillips 66 Comment Summary Table

P66-24 cont

#	Page Number	Paragraph, Table or Figure	Subject of Comment (Specific Item or Language)	Comment/Explanation of Issue	Recommended Action
				expertise regarding rail car design, construction and retrofits, and it is important that the County not get ahead of the PHMSA on this issue. The Option 1 Tank Cars as described in the NPRM may not provide a safe option and may not be feasible to implement by the time the Project starts operations. The PHMSA received several comment letters concerning the safety and feasibility of implementing the Option 1 Tank Cars before the comment period closed on September 30, 2014. For example, the Railway Supply Institute's Committee on Tank Cars ("RSI-CTC") submitted a letter explaining that the Option 1 Tank Cars should be eliminated as a possibility altogether. Railway Supply Institute, Committee on Tank Cars Comment Letter, submitted to the PHMSA on September 30, 2014, p. 1. A copy of the RSI-CTC Comment Letter is provided as Attachment B. The RSI-CTC's members collectively build more than 95 percent of all new railroad tank cars, and they own and provide for lease over 70 percent of railroad tank cars operating in North America. Id. As the RSI-CTC 4explains, there are several technical problems with the Option 1 Tank Cars as proposed in the PHMSA. Id. at pp. 9-10. The RSI-CTC's concerns include, among others, that: (1) the asserted rollover protection is largely unproven in the general purpose tank car context and could cause unintended adverse structural consequences; (2) the electronically controlled pneumatic brakes do not offer significant safety advantages during a derailment scenario as compared to other alternative braking systems; and (3) increasing tank shell thickness could affect the performance of other safety features in a derailment because of the increased jacket weight. Id.	

Phillips 66 Comment Summary Table

P66-24 cont

#	Page Number	Paragraph, Table or Figure	Subject of Comment (Specific Item or Language)	Comment/Explanation of Issue	Recommended Action
				The RSI-CTC also explains that the proposed timeline in the NPRM to implement the Option 1 Tank Cars is not achievable. The RSI-CTC provides detailed estimates of the number of tank cars in service that would need to be modified, and explains that a survey of maintenance and repair shop capacity reveals only approximately 15,000 of the NJ legacy tank cars could realistically be modified by the deadline proposed in the NPRM. Id. at p. 25. The RSI-CTC also explains that modifications to tank cars involve an "extremely complex process that requires numerous engineering, safety and mechanical activities to occur both in preparation for and after application of the features required by the Proposed Regulations." Id. at p. 27. Other practical constraints will hamper the feasibility of manufacturing the Option 1 Tank Cars or making modifications to existing cars, such as availability of materials and component parts, limited availability of skilled labor, and other maintenance orders facilities address at the same time. Id. at pp. 29-30. The American Association of Railroads ("AAR") also submitted comments to the NPRM expressing concerns about the Option 1 Tank Cars. See Association of American Railroad's Comments submitted to the PHMSA on September 30, 2014. A copy of the AAR Comment Letter is included as Attachment C. The AAR's member railroads account for most of the rail transportation of flammable liquids. Id. at p. 1. The AAR expressed similar concerns about the effectiveness of the requirements for Option 1 Tank Cars for safety, and the aggressive phase	

Phillips 66 Comment Summary Table

	#	Page Number	Paragraph, Table or Figure	Subject of Comment (Specific Item or Language)	Comment/Explanation of Issue	Recommended Action
P66-24 cont					out schedule proposed in the NPRM. Id. at pp. 15, 41-42. Based on the comments received by the RSI-CTC, the AAR, and several other entities, the specifications of the Option 1 Tank Cars may not be the most effective way to enhance safety. Moreover, the Option 1 Tank Cars likely will not be available in sufficient numbers to support the Project. Without this mitigation measure, as the Revised DEIR explains, Phillips 66 has already committed to shipping crude oil to the refinery in non-jacketed CPC-1232 tank cars (i.e. post October 1, 2011 tank cars). Revised DEIR, p. ES-5. The rail cars will be designed to meet DOT Packing Group I requirements, the highest rating. Id. The tank cars will also be equipped with half height head shields, double couplers, and all stainless steel valves. Id.	
P66-25	25	4.8-20	First Paragraph	Coastal Plan Policies/Title 23.04.420	The first full paragraph does not accurately describe the condition of approval for the Throughput Increase Project relating to coastal access. See comment on page ES-1, ¶ 2. Phillips 66 nonetheless agrees with the conclusion in the fourth paragraph that “Compliance with the previous conditions of approval would ensure the Rail Spur Project’s consistency with these policies.” As explained in the third paragraph, “If … it was determined that coastal access at this location was not feasible or appropriate due to safety concerns, sensitive resources, or other conditions that fall within an exception listed in Section 23.04.420, then those conditions would be equally	Revised description of the condition of approval and applicable policy consistency criteria.

Phillips 66 Comment Summary Table

	#	Page Number	Paragraph, Table or Figure	Subject of Comment (Specific Item or Language)	Comment/Explanation of Issue	Recommended Action
P66-25 cont					applicable to a consideration of coastal access as a component of the Rail Spur Project." The Rail Spur Project will be consistent with the coastal access policies if either Phillips 66 makes an offer of dedication, or it is demonstrated that an exemption applies.	
P66-26	26	4.9-26	Mitigation N-2b	Pump Noise Limitations	This mitigation measure is aimed at addressing potential impacts of operating pumps. The timing is specified as "Prior to issuance of the Notice to Proceed." In order to demonstrate that the operating pumps can meet the noise limitations, they must be installed and operating.	The timing of the mitigation measure should be revised to require that the evidence be provided to the County upon installation and initial operation.
P66-27	27	4.11-28	Mitigation Ps-4b	Tank Car Design	This mitigation measure is aimed at addressing potential impacts of operations on the mainline UPRR tracks associated with the Project by restricting the Project to Option 1 Tank Cars. For the reasons described above under the feasibility comment for HM-2a, this mitigation measure is infeasible and should be revised accordingly.	The mitigation measure should be deleted because it is premature and infeasible.
P66-28	28	4.13-32	Mitigation WR-6	Recycled Water	This mitigation measure is aimed at addressing the Project's potential impacts to water resources by requiring, if possible, that the Applicant use recycled water for construction and operational activities. This mitigation measure is not feasible, as recycled water is not suitable for land application. Further, this mitigation measure does not account for the increase in diesel emissions caused by the truck transport of any recycled water that cannot be generated onsite. The Revised DEIR concludes that the Project will not significantly impact the quantity or movement of available ground water or adversely affect a community water service provider. Revised DEIR, pp.	This mitigation measure should be removed from the Final EIR.

Phillips 66 Comment Summary Table

	#	Page Number	Paragraph, Table or Figure	Subject of Comment (Specific Item or Language)	Comment/Explanation of Issue	Recommended Action
P66-28 cont					4.13-29-31.	
P66-29	29	9-1	First Paragraph	Coastal Access	This paragraph should clarify that Phillips 66 has not proposed a "Coastal Access Project". Based on the information in the Revised Draft EIR, these comments, and the Coastal Access Feasibility Review (ARCADIS, August 2013) cited at page 9-72, Phillips 66 anticipates that County will conclude that it is exempt under Section 23.04.420 (c).	Clarify paragraph as described.
P66-30	30	9-13	Throughout Section	Docent Led Hikes	This section uses the phrase "docent-led tours" interchangeably with "docent led access". To avoid confusion, "tours" should be deleted and replaced with "access" in this section and everywhere else it appears in the Revised Draft EIR. Under certain circumstances, the Coastal Zone Land Use Ordinance requires development projects to offer vertical access from the first public road "to the shore". The Ordinance does not require the private property owner to open the property to tours or other recreational pursuits.	Rectify terms throughout section as described..
P66-31	31	9-14	Top Paragraph	At Grade Crossing	This paragraph states: "For purposes of this analysis, it has been assumed that a grade-separated crossing would not be needed for docent-led tours, but that the railroad crossing would be upgraded to include automatic signals and gates to protect the docent-led groups from crossing the tracks when a train is approaching." There is no explanation for why this assumption is reasonable. Elsewhere, the Revised Draft EIR states: "It is … uncertain if a grade-separated crossing of the Union Pacific railroad tracks would be needed for this level of	Modify the discussion of the potential need for grade- separated crossing. Same comment and response for Page 9-64.

Phillips 66 Comment Summary Table

	#	Page Number	Paragraph, Table or Figure	Subject of Comment (Specific Item or Language)	Comment/Explanation of Issue	Recommended Action
P66-31 cont					access. If the California Public Utilities Commission (CPUC) considers the docent-led access to be a public crossing, then it is possible that a grade-separated crossing would be required." See Revised Draft EIR at page ES-21. Also, UPRR is under no obligation to provide public access across the tracks, and may insist in separated grade crossing as a condition of allowing access. Page 9-14 needs to acknowledge that the assumption of at-grade crossing is uncertain at best, and that if a grade-separated access structure were required, most of the impacts would be identical to those identified for bicycle/pedestrian access.	
P66-32	32	9-65	Throughout Section	Public Safety	This section mentions only two of the public safety risks presented by public access across the SMR: the risk of members of the public being injured or killed in the event of an incident at the refinery, and the potential for interference with emergency response activities at the refinery. Public safety risks identified elsewhere in the Revised Draft EIR should be discussed here as well. These include bringing the public to the railroad, when Phillips 66 has no legal right to grant them safe passage across the tracks. Page 9-65 of the Revised Draft EIR characterizes refinery incidents affecting members of the public as "extremely unlikely." The same cannot be said of the risk of harm to people crossing the railroad tracks at an at-grade crossing. Pages 4.7-4 through 4.7-5 shows that nearly every year from 2003 through 2012 people in San Luis Obispo County were killed or injured trespassing across the railroad tracks. According to the Revised Draft EIR at page 9-58,	Expand the public safety discussion to include all of the risks described in RDEIR.

Phillips 66 Comment Summary Table

	#	Page Number	Paragraph, Table or Figure	Subject of Comment (Specific Item or Language)	Comment/Explanation of Issue	Recommended Action
P66-32 cont					this public safety concern is not even eliminated by construction of a pedestrian overpass because "recreational users … [may] stray from the trail and explore areas along the railroad tracks." The Revised Draft EIR also identifies public safety risks associated with members of the public sharing a narrow road designed for maintenance of industrial facilities and regularly traveled by heavy vehicles and equipment.	
P66-33	33	Appendix G	G-5	Coastal Plan Policies Chapter 2	The discussion does not accurately describe the condition of approval for the Throughput Increase Project relating to coastal access. See comment on page ES-1, ¶ 2. Nonetheless, Phillips 66 agrees with the conclusion that the project will be consistent with Coastal Plan Policy 2 because the project qualifies for two exemptions stated in the policy.	Revise the description of the condition of approval.
P66-34	34	Appendix G	G-45	Coastal Plan Policies Chapter 2	The discussion does not accurately describe the condition of approval for the Throughput Increase Project relating to coastal access. See comment on page ES-1, ¶ 2. Nonetheless, Phillips 66 agrees with the conclusion that the project will be consistent with Coastal Plan Policy 2 because the project qualifies for two exemptions stated in the policy.	Revise the description of the condition of approval.

and official seal. Chas. C. King Notary Public Filed for record at request of C. C. Phillips, February 7th A.D. 1891 at 20 min. past 10 o'clock A.M.

J. F. Fiedler
Recorder

Henry Bosse to S. P. R. R. Co.	Know all Men by these Presents: That Henry Bosse of the County of San Luis Obispo and State of California, in consideration of the benefits to be derived by me in the construction of the Southern Pacific Rail Road Company's Railroad, and of One Dollar to me in hand paid, the receipt whereof is hereby acknowledged do hereby bargain, and agree to, and with the Southern Pacific Railroad Company, upon the payment to me or my legal representatives of the sum of Three hundred Dollar, to sell and convey to said Company, all that certain piece or parcel of land situated in the County of San Luis Obispo, State of California and the conveyance shall contain the following conditions: And said first party hereby grants to said second party the right to extend the slopes of their cuttings or embankments and to build, and maintain culverts, and surface ditches beyond the limits of the herein described right of way, where necessary for the proper construction and maintenance of the said second party's railroad. also the right to quarry and haul stone for the construction of culverts and bridges from, and to enter upon the land of said first party, and camp men and haul material and supplies for the construction and maintenance of said railroad; upon the condition that said second party shall fence said railroad right of way, and grade when required by said first party, as soon as practicable after said railroad is constructed and that said second party shall build and maintain suitable over or under or grade or gate or cattle-guard crossings at such points as said first party shall show to be necessary for access to and use of his lands, provided such crossings are deemed practicable by the Chief Engineer of said second party, and provided the situation and character of said crossings are requested and duly accepted by said first party prior to the [illegible] of said second parties [illegible] and said crossings shall not to exceed five [illegible] in number and

being a portion of the Rancho Bolsa de Chemisal San Luis Obispo Co Cala. and generally designated as "Oso Flaco" and being that portion of said Rancho Bolsa de Chemisal lying South of Laguna Negra and North of Rancho Guadalupe said County of San Luis Obispo, Cal and more particularly described as follows, to wit: — Commencing for the same at a point on the centre line of the Southern Pacific Rail Road Co's Railroad where the line of the same as finally located may or shall intersect the Northerly line of said "Oso Flaco" and running thence Southerly along said center line of said Southern Pacific Rail Road Co's railroad and embracing a strip of land fifty (50) feet wide on each side of said center line, to the Southerly boundary line of the lands of said Henry Bosse at or near the Northerly boundary line of the Rancho Guadalupe San Luis Obispo County California together with all the appurtenances thereto belonging. And the Engineers, Agents, employees, and Contractors of said Company are hereby authorized to enter upon said land for the purposes of the survey and construction of said Railroad. In case said Railroad shall not be located on said land this agreement shall be null and void. In Witness Whereof I have hereunto set my hand and seal, this 27th day of December 1890 Henry Bosse (Seal) Signed, Sealed and delivered in the presence of H. H. Carpenter

State of California }
County of San Luis Obispo } "On this twenty seventh day of December, in the year 1890, before me, Chas. C. King, a Notary Public in and for the said County of San Luis Obispo, personally appeared Henry Bosse known to me to be the same person described in whose name is subscribed to the within instrument, and he acknowledged to me that he executed the same Witness my hand and official seal. Chas. C. King Notary Public (Seal) Filed for record at request of C. H. Phillips February 7th A. D. 1891 at 20 min past 3 o'clock A. M.

C. F. Evans
Recorder.

Support, Connection, Advocacy

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September 30, 2014

Via Federal eRulemaking Portal: www.regulations.gov

Docket Management System
U.S. Department of Transportation
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Washington, D.C. 20590

RE: Comments of the Railway Supply Institute, Committee on Tank Cars regarding the Pipeline and Hazardous Materials Safety Administration Notice of Proposed Rulemaking for Hazardous Materials: Enhanced Tank Car Standards and Operational Controls for High-Hazard Flammable Trains, Docket No. PHMSA-2012-0082 (HM-251)

Dear Sir or Madam:

The Railway Supply Institute ("RSI") is the international trade association of the railway supply industry. Its members provide all types of goods and services to freight and passenger railroads, rail shippers and freight car manufacturers and lessors. The members of the RSI Committee on Tank Cars ("RSI-CTC") collectively build more than ninety-five percent (95%) of all new railroad tank cars and own and provide for lease over seventy percent (70%) of railroad tank cars operating in North America. These comments are submitted on behalf of the following RSI-CTC members: American Railcar Industries; American Railcar Leasing; CIT Rail; GATX Corporation; General Electric Railcar Services Corporation; Trinity Rail Group, LLC; and Union Tank Car Company. The RSI-CTC has a demonstrated commitment to safe rail transportation by tank car. This includes its long-standing participation in the Railroad Tank Car Safety Research and Test Project ("Tank Car Safety Project") with the North American Class I Railroads (through the Association of American Railroads ("AAR")) and regulators from both the United States and Canada whereby the RSI-CTC contributes funding, technical resources and thought leadership to the detection, prevention and mitigation of equipment-related factors in train accidents.

The RSI-CTC commends the U.S. Department of Transportation ("DOT"), Pipeline and Hazardous Materials Safety Administration's ("PHMSA") efforts to improve the safe transportation of hazardous materials as outlined in its Notice of Proposed Rulemaking for Hazardous Materials: Enhanced Tank Car Standards and Operational Controls for High-Hazard Flammable Trains, Docket No. PHMSA-2012-0082 (HM-251) ("Proposed Regulations" or "NPRM") and appreciates the opportunity to submit its comments on the

Proposed Regulations. The RSI-CTC shares PHMSA's commitment to a safe and efficient rail transportation system and to ensuring the continued growth and vitality of an integrated North American energy market. As set forth below, the RSI-CTC endorses various aspects of the Proposed Regulations as the most effective means for addressing the complex issues presented. In other areas, the RSI-CTC believes that the Proposed Regulations could be better tailored to optimize risk reduction more effectively without unnecessary economic disruptions and unintended consequences that could implicate other safety concerns. In those instances, the RSI-CTC has accepted PHMSA's invitation to suggest alternative solutions for the agency's consideration.

Finally, we ask PHMSA to bear in mind that the Proposed Regulations do not exist in a vacuum. Concurrently, Transport Canada is undertaking its own rulemaking (the "TC Proposed Regulations") that is intended to address the same issues covered by the PHMSA Proposed Regulations. At present, there are fundamental differences between the PHMSA Proposed Regulations and the TC Proposed Regulations that require harmonization, given the integrated nature of the North American rail system and the economies and industries that it supports. Specifically, both sets of regulations will have significant impacts on the transportation of flammable liquids, including crude oil and ethanol, throughout North America. Absent harmonization, the producers of these commodities will face severe, certain, and unintended economic consequences caused by transportation service interruptions.

I. Executive Summary

The RSI-CTC shares PHMSA's commitment to a safe and efficient rail transportation system and to ensuring the continued growth and vitality of an integrated North American energy market.

In the sections below, we will discuss the following key comment areas:

- The RSI-CTC supports PHMSA's holistic approach to improving the safety of hazardous materials transportation by rail by focusing on derailment prevention in addition to post-derailment mitigation.

- Harmonization of the U.S. and Canadian requirements is essential to ensure the viability of key segments of the North American economy.

- A rule governing tank car specification that is predicated upon train makeup and railroad operations provides neither the necessary advance notice nor the certainty to determine packaging requirements. Accordingly, "High-hazard flammable trains" is not a workable concept for determining tank car specifications. Tank car specifications should instead be determined by the commodity transported.

- PHMSA's final rule should include only feasible, cost-justified, prescriptive standards, clear definitions, and achievable timelines.

- Newly built tank cars transporting crude oil and ethanol (in all Packing Groups) should be built with a 9/16 inch tank shell, jacket, full-height half inch head shields, top fittings protection, a reconfigured bottom outlet valve handle ("BOV"), a reclosing pressure relief valve ("PRV"), TC128 Grade B normalized steel, and a thermal protection system. This is consistent with Option 2.

- Newly built tank cars transporting the balance of other Class 3, flammable liquids in Packing Group ("PG") I, II, or III, should be built with a 7/16 inch tank shell, jacket, full-height half inch head shields, top fittings protection, a reconfigured BOV, a reclosing PRV, TC128 Grade B normalized steel, and a thermal protection system. This is consistent with Option 3.

- Existing tank cars serving all Class 3, PG I and II commodities including crude oil and ethanol should remain in service with the existing head and shell as a base and undergo modification that would include jackets (if not already present), full-height half inch head shields, a reconfigured BOV, a reclosing and appropriately sized PRV, and a thermal protection system in accordance with 49 C.F.R. § 179.18.[1] This is consistent with Option 3. The RSI-CTC agrees with PHMSA that top fittings protection is not a cost justified modification for existing tank cars.

- Modifications to existing tank cars transporting Class 3, PG III commodities should be limited to the application of a reconfigured BOV and a reclosing PRV.

- The compliance deadlines for the modification program must account for the complexity of the modifications and the constraints of the maintenance and repair facility network to provide sufficient time to avoid the substantial unintended consequences of an unrealistic modification timeline.

- We support rigorous benefit cost analysis to inform the final rule, and suggest elements of such an analysis.

- PHMSA's final rule should be free of legal uncertainties that could hinder effective implementation, public safety protections, or commerce.

II. The RSI-CTC Supports PHMSA's Holistic Approach to Improving the Safety of Hazardous Materials Transportation by Rail

At the outset, the RSI-CTC applauds PHMSA for working with the Federal Railroad Administration ("FRA") to create Proposed Regulations that not only address tank car requirements, but also address aspects of railroad operations and shipper classification. We completely agree that safe transportation of hazardous materials by rail requires simultaneous focus on the entire integrated system: railway infrastructure, track maintenance, railway operations, product classification, equipment standards and human factors. Tank car requirements cannot be examined in isolation, as they are only one aspect of rail transportation. Although enhanced tank car features may mitigate the effects of certain post-derailment consequences, implementing changes to tank car requirements will not prevent derailments from occurring in the first place.

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[1] 49 C.F.R. § 179.18 requires that a tank car have sufficient thermal resistance "so that there will be no release of any lading within the tank car, except release through the pressure release device, when subjected to (1) a pool fire for 100 minutes; and (2) a torch fire for 30 minutes."

The RSI-CTC shares PHMSA's commitment to improving the safe transportation of hazardous materials by rail. RSI and its predecessors have been working with the AAR since 1970 to fund the Tank Car Safety Project. The data collected by the Tank Car Safety Project describing damage to tank cars in train accidents is available to industry researchers to support studies of potential enhancements to tank car construction, design, and material standards.

We also would support future regulatory actions by PHMSA and the FRA that would address derailment prevention and not just post-derailment mitigation. As PHMSA Administrator Cynthia Quarterman stated before Congress in testimony earlier this year, "[f]irst we need to prevent derailments. Getting a new tank car is not a silver bullet."[2] We agree with Administrator Quarterman's conclusions that no tank car, no matter how it is designed or constructed, could reasonably be expected to withstand the derailment forces of an event comparable to Lac Mégantic. PHMSA's own data reinforces these statements and underscores the importance of derailment prevention.

Of the major crude oil and ethanol incidents referenced in the NPRM where a root cause has been determined, nearly all of these incidents were caused by track integrity issues such as rail defects and washouts or by human error.[3] This is consistent with PHMSA's finding that "broken rails or welds, track geometry, and human factors…are the leading causes of derailments."[4] Exhibit A1 below illustrates that human error and track problems are the most common causes of all derailments between 2004 and 2013. The proportion of derailments resulting from human error or track related causes has also remained relatively constant with an average proportion of 74%, a minimum proportion of 72%, and a maximum proportion of 76% during this period. The consistently high proportions of mainline derailments due to track or human causes suggest that there is more that the industry and regulators can do to enhance accident prevention.

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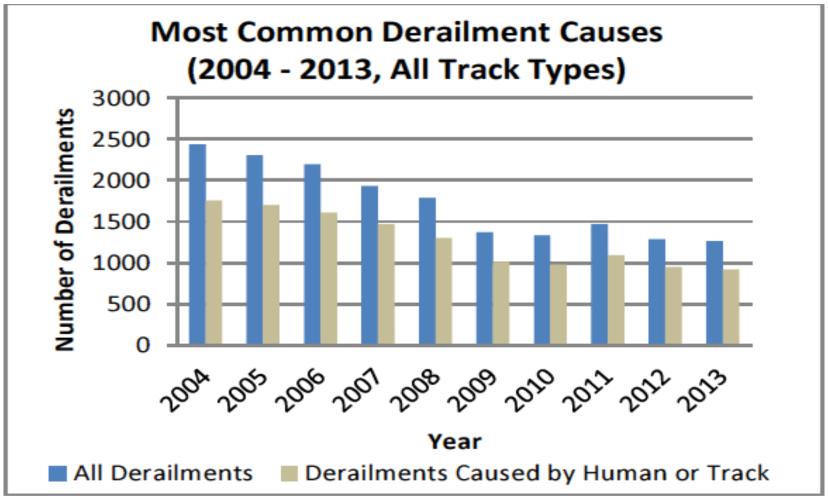
[2] Hearing on "Oversight of Passenger and Freight Rail Safety," Before the H. Comm. Transportation and Infrastructure (Feb. 26, 2014) (statement of Cynthia L. Quarterman, PHMSA Administrator), transcript available at http://www.gpo.gov/fdsys/pkg/CHRG-113hhrg86845/pdf/CHRG-113hhrg86845.pdf.

[3] Hazardous Materials: Enhanced Tank Car Standards and Operational Controls for High-Hazard Flammable Trains, Docket No. PHMSA-2012-0082 (HM-251), 79 Fed. Reg. 45018, at 45020, Table 3 (proposed Aug.1, 2014) (hereafter "NPRM").

[4] NPRM, 79 Fed Reg. at 45026.

Exhibit A1[5]



For example, while many aspects of the Proposed Regulations are designed to mitigate post-derailment consequences (such as reduced operating speeds and additional tank car requirements), there are several outstanding items which, if addressed in conjunction with this rulemaking, would yield even greater overall safety benefits, because they are related to derailment prevention efforts. These include:[6]

- Finalizing rules for Railroad Safety Risk Reduction Programs
- Finalizing rules for Training Standards for Railroad Employees
- Finalizing rules for Controlled Substance Testing

The Proposed Regulations reflect appropriate and welcome safety enhancements. In order to realize their full potential, however, we urge PHMSA and FRA simultaneously to address the above items. The RSI-CTC looks forward to engaging with the agencies in these endeavors.

III. Harmonization is Essential to Ensure the Viability of Key Segments of the North American Economy

Currently, the PHMSA Proposed Regulations and the TC Proposed Regulations contain different requirements for new tank car specifications and existing car modifications, different timelines for compliance with the modification requirements and different criteria for determining the applicability of the proposed regulations. It is critical that the U.S. and Canada work closely together to create a single harmonized standard for tank cars in order to ensure the viability of transporting flammable liquids by rail throughout North America. The specific inconsistencies between the two countries' proposals include:

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[5] Federal Railroad Administration ("FRA"), Office of Safety Analysis, derailment database.

[6] These items were identified by the FRA as significant actions it intended to undertake in 2014 in a presentation to the Railroad Safety Advisory Committee ("RSAC"). *See* FRA Regulatory Activity Update to the 51st RSAC Committee Meeting (March 6, 2014), available at https://rsac.fra.dot.gov/meetings/20140306.php.

- Compliance timelines
- New tank car shell and head thickness requirements
- Modification requirements
- Scope of the rule (crude oil and ethanol versus all flammable liquids)

A comparison table outlining the specific differences between the three PHMSA options and the TC proposal can be found in Appendix A.

During a recent summit of North American Business, Civil Society, and Education Leaders in February of 2014, U.S. President Barack Obama remarked that,

> So much of the cross-border trade that exists is part of an integrated supply chain that allows us, [the U.S. and Canada], to successfully sell our products and services all around the world. And so we have every incentive to make this work. And so a lot of our conversation has focused on how do we reduce any continuing trade frictions; how do we make sure that our borders are more efficient…[7]

Canadian Prime Minister Stephen Harper echoed these sentiments stating that, "Today, Canadian [and] American…companies do much more than sell things to each other. [They] increasingly make things together through integrated supply chains…[which] is why we want to tighten our relationships and increase the competitiveness in the region."[8]

These remarks demonstrate the priority that both countries have placed on ensuring the economic viability of the North American markets, which can only be achieved through harmonized policies and regulations. Regulatory alignment, especially on important "upstream" issues like this, is also the stated goal of the ongoing Canada-U.S. Regulatory Cooperation Council, unveiled personally by President Obama and Prime Minister Harper in early 2011. As we emphasized in our comments to Transport Canada on September 1, 2014, it is wholly unrealistic to assume that there is or could be a discrete set of tank cars available to operate in the U.S. while another would operate in Canada. Most of the tank cars carrying the commodities covered by the Proposed Regulations operate in cross-border service. It is infeasible to segregate cars by those loaded or offered for transportation in the U.S. only versus those loaded or offered for transportation in Canada only. Tank car stakeholders cannot reasonably be expected to adhere to one set of regulations in Canada and another set of regulations in the U.S.

Following the derailment in Lac Mégantic, Canada, the two countries have continued their tireless work to address the safe transportation of flammable liquids by rail. Both the U.S. and Canadian transportation agencies are confronting—at the same time—the same issues, across the same integrated rail network, involving the same tank cars,

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[7] Remarks by President Obama, President Peña Nieto, and Prime Minister Harper to North American Business, Civil Society, and Education Leaders (February 19, 2014), available at http://www.whitehouse.gov/the-press-office/2014/02/19/remarks-president-obama-president-pe-nieto-and-prime-minister-harper-nor.

[8] *Id*.

which are used to transport the same flammable liquids across the border. As our economies are intrinsically linked, it is imperative that these regulatory proposals are consistent and harmonized. Transport Canada has explicitly stated its commitment to "a North American solution for tank car standards,"[9] and we respectfully urge the DOT to make the same commitment and to continue to work as closely as possible with Transport Canada to create a final, harmonized regulation. Otherwise, and without corresponding safety benefits, stakeholders will incur unintended costs and inefficiencies attempting to meet inconsistent standards contained in each final rule.

IV. Scope of the Proposed Regulations: the HHFT Definition is Unworkable; Commodity Focus is Better Alternative

The RSI-CTC appreciates the intent behind the use of the High-Hazard Flammable Train ("HHFT") concept in the Proposed Regulations. Through the HHFT definition—a train comprised of 20 or more carloads of a Class 3 flammable liquid[10] —PHMSA appears to be seeking to limit the applicability of the rule to a discrete group of commodities operating in a specified train service. Although the rule pertains to all Class 3 flammable liquids on its face, and to trains with as few as twenty carloads of those commodities, PHMSA assumes that the practical impact of the Proposed Regulations will be limited to unit train shipments of crude oil and ethanol only. Indeed, its cost-benefit analysis is structured based upon this assumption. As set forth in detail below, this assumption is flawed.

Any final rule must provide car owners and shippers with sufficient advance notice of and certainty as to which tank cars are covered. Otherwise, these stakeholders will be forced to guess which cars are within the scope of the rule. As a result, they either risk non-compliance if they are wrong or will have to modify all cars potentially within the scope of the rule and likely waste time and other resources. A rule predicated upon railroad operating practices provides neither the necessary advance notice nor certainty.[11] Both the HHFT concept and unit train concept, which others in the industry have proposed as an alternative, improperly base coverage upon railroad operating practices.

A. HHFTs[12]

Under the HHFT definition, the applicability of the Proposed Regulations to a given shipment is predicated upon how the associated tank car moves from origin to

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9 Transport Canada, "Explanatory Note - Consultations on Proposed Amendments to the Transportation of Dangerous Goods Regulations (New Class TC140 Tank Cars for the Transport of Dangerous Goods)" at p. 6, available at http://www.tc.gc.ca/eng/tdg/clear-modifications-menu-1193.html (stating that "it is important that in the longer-term, Canada be harmonized with North American requirements to the greatest extent possible.").

10 NPRM, 79 Fed. Reg. 45017.

11 The "20 or more carloads" requirement derives from existing Circular OT-55-N, establishing "Recommended Railroad Operating Practices for Transportation of Hazardous Material." *See* NPRM, 79 Fed. Reg. 45024.

12 This section is responsive to Q1 - HHFTs, 79 Fed. Reg. 45040.

destination. In other words, it requires all shippers to know in advance the type of train(s) in which their cars will move and to know the types of commodities and number of tank cars introduced by other shippers that will make up the train during shipment. Tank cars carrying specified commodities in HHFTs would fall under the Proposed Regulations, yet the same tank cars carrying the same commodities that do not move in HHFTs would not be covered by the Proposed Regulations. The fundamental flaw underlying this approach, however, is the notion that a shipper has advance notice of or control over the type of train in which its tank car moves or that the type of train in which it moves remains static from origin to destination.

Neither of these assumptions is true. At any point during transit, an ordinary manifest train carrying less than 20 car loads of a covered commodity could become a HHFT if the handling railroad decided to accept the requisite number of additional carloads of such commodity from another shipper. None of the parties offering shipments to the railroad would have control over this. As a result, a tank car shipper would never know if its compliance obligations would be triggered until it was too late. The only way to remove this uncertainty would be to resort to deploying HHFT-compliant tank cars only, whether or not they ultimately would be transported in a HHFT. This would unduly deprive the shipper of flexibility and likely impose unnecessary costs. Such costs are not taken into account by PHMSA.

B. Unit Trains

The RSI-CTC agrees with PHMSA that the recent expansion in U.S. energy production "has led to significant challenges in the transportation system" related to the rising volumes of shipments of crude oil and ethanol.[13] As the agency notes, the volume of crude oil carried by rail increased 423% between 2011 and 2012, and U.S. ethanol production has experienced similar growth over the last decade. To accommodate these rising shipment volumes, rail carriers began using trains dedicated entirely to the transportation of a single commodity such as crude oil or ethanol. These "unit trains" typically range from 50-120 cars, with each tank car carrying the same commodity. Unit trains are more efficient, because the switching of rail cars in intermediate yards is eliminated, making the overall duration of a given trip shorter. However, we recognize the increased risk associated with transportation of crude oil and ethanol in unit trains, and we agree that the Proposed Regulations should reflect this unique risk.

Unfortunately, a rule that defines scope by reference to unit trains is largely saddled with the same notice and uncertainty problems as one that refers to HHFTs. Stakeholders still would unfairly be subject to the vagaries of railroad operating practices. To date, the rules surrounding operation of unit trains and trains subject to OT-55-N (the basis for the HHFT definition) have worked, because the same entity—a railroad—is governed by and is in control of the activities associated with those rules. That is not the case with the Proposed Regulations. The RSI-CTC respectfully submits that tank car packaging requirements should not be dictated by activities outside of the car owner or shipper's control, and that the unit train risk is better addressed through prioritization of modifications to the existing fleet.

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13 NPRM, 79 Fed. Reg. 45017.

C. Scope should be determined by commodity transported

Rather than using railroad operating practices to dictate packaging requirements, the RSI-CTC recommends using the commodity transported to determine whether a given tank car falls within the scope of the Proposed Regulations. This is consistent with the approach taken by Transport Canada in the TC Proposed Regulations. We support this methodology because it establishes a clearer and more efficient means of ensuring compliance with the regulation. Since a tank car shipper knows well in advance the commodity it intends to transport, a commodity-based approach removes uncertainty and promotes flexibility. Unlike the HHFT or unit train approach, this scenario provides a tank car shipper with fair notice of any compliance obligations and the opportunity to select the tank car that suits its needs.

D. Scope should Include Crude Oil, Ethanol, and all Class 3, PG I, II and III Flammable Liquids

The RSI-CTC fully supports PHMSA's inclusion of crude oil, ethanol and other Class 3, Packing Group ("PG") I, II and III commodities within the Proposed Regulations. Despite PHMSA's emphasis on crude oil and ethanol shipments in the Proposed Regulations, it nonetheless is important to keep other Class 3 flammable liquids, in PG I, II and III, within the scope of the rule. Having these other commodities covered by the Proposed Regulations optimizes the safety impact of the final rule by improving the safety of the overall fleet.

The importance of regulatory certainty to the health of our energy markets cannot be underestimated. It is the experience of the RSI-CTC that the ongoing uncertainty surrounding final tank car requirements has served as a disincentive for investment. Accordingly, we suggest that it would be prudent to include all Class 3 flammable liquids within the scope of the rule at this time, rather than wait for another potentially protracted rulemaking to address commodities other than crude oil and ethanol. For new cars, this means new builds for any Class 3, PG I, II, or III commodity would be impacted by the final rule. For existing cars, this means the entire fleet would eventually be modified but different modifications would be required for different subsets of the fleet. As discussed in Section VIII and IX, we support modification of tank cars in other flammable liquid service, provided that these commodities are addressed *after* crude oil and ethanol, and that the compliance deadline is reasonable and achievable. This would maximize the safety impact of the final rule and provide the greatest degree of regulatory certainty to tank car manufacturers, owners, shippers, and lessors.

V. Option 1 Should be Eliminated as a Feasible Alternative for New Builds or Existing Tank Cars

The RSI-CTC opposes Option 1 as a feasible alternative for either new builds or existing tank cars for the following reasons. First, rollover protection is largely unproven in the general purpose tank car context, likely will add only slight safety benefits to such tank cars, and may have unintended adverse structural and negative commercial consequences. A full discussion of rollover protection, as compared to top fittings protection for new builds, is set forth in Section VII.C. Second, Electronically Controlled Pneumatic ("ECP") brakes do not offer significant safety advantages during a derailment scenario as compared to other alternative braking systems. Moreover, this technology only works if the entire train (railcars and locomotives) is equipped with ECP technology. Therefore, tank cars equipped with ECP brakes would need an overlay system. Discussion of ECP brakes and other braking systems is contained in Section VII.D.

Finally, modifying existing tank cars to meet a higher tank shell thickness requirement is not a concept that merits serious consideration for the reasons discussed in Section VIII.E. Because the only way to increase the tank thickness is by adding a thicker jacket to the tank car, this modification 1) would require special equipment to manage the thicker steel; 2) may adversely affect the performance of other safety features in a derailment due to increased jacket weight; and 3) may also introduce stresses that reduce the fatigue life in other areas of the tank.

For these and other reasons discussed below, Option 1 should be eliminated, because it is not a feasible, cost-justified alternative.

VI. Differentiated Requirements for New and Existing Tank Cars are Reasonable and Warranted Under the Circumstances

The RSI-CTC submits that a one-size-fits-all approach for tank car requirements for both new and existing tank cars is not practical. Nor would it be an efficient use of limited North American tank car manufacturing and modification resources. There is precedent in this and other industries where safety objectives were deemed to have been satisfied under rules with differing sets of requirements for future manufacturing vs. existing equipment. Implicit in this precedent is the recognition that overall safety may be best served by an approach that combines future builds at a higher standard with meaningful modifications to the largest possible segment of the existing population over the shortest reasonable timeframe. Requiring equivalency between the two could serve as a distinct disincentive to innovation. For these reasons, and as set forth more fully below, the RSI-CTC suggests that PHMSA clearly differentiate the requirements for new cars from the modifications that would be required for existing tank cars.

VII. New Builds

As applicable to tank cars transporting crude oil and ethanol (PG I, II, or III), the RSI-CTC agrees with the new car construction requirements for the proposed DOT-117 as set forth in Option 2 of the Proposed Regulations, including the requirements for jackets, full-height half inch head shields, top fittings protection, a reconfigured BOV handle, a reclosing PRV, the use of TC128 Grade B normalized steel, and a thermal protection system. We also agree that a 9/16 inch tank shell is appropriate for the transportation of crude oil and ethanol as called for in the construction of new DOT-117 tank cars under Option 2.

For newly built tank cars intended to serve the balance of other Class 3, flammable liquids in PG I, II, or III service, the RSI-CTC supports Option 3, with a 7/16 inch shell thickness. The risk associated with crude oil and ethanol is derived from the volume and density of shipments of those commodities, because crude oil and ethanol typically travel in unit trains. PHMSA has not demonstrated that other Class 3, flammable liquids represent a risk in transportation that warrants transport in a thicker tank car. Therefore, for new cars in other Class 3 flammable liquid service, we support new car requirements consistent with the enhanced CPC-1232 that include: a 7/16 inch thick tank shell, jacket, full-height half inch head shields, top fittings protection, a reconfigured BOV handle, a reclosing PRV, the use of TC128 Grade B normalized steel, and a thermal protection system.

We note that this second set of requirements, absent the requirements for normalized steel and top fittings protection, would also be applicable to all modified tank cars currently operating in Class 3, PG I and II service, regardless of commodity, as discussed in Section VIII below.

A. Tank Car Thickness for New Builds

As stated above, the RSI-CTC supports a requirement that new tank cars entering crude oil and ethanol service be built with a 9/16 inch thick tank shell. The risk associated with the movement of crude oil and ethanol in unit trains reasonably supports this thicker packaging requirement. However, by contrast, new tank cars intended to serve the balance of Class 3, PG I, II, and III commodities do not typically move in unit train service and therefore do not represent a comparable risk. Accordingly, the RSI-CTC submits that new tank cars in other Class 3 flammable liquid service should be built with a 7/16 inch thick tank shell. In other words, crude oil and ethanol would be transported in a thicker shelled tank car (Option 2), and other flammable liquids would be transported in the enhanced jacketed CPC-1232 tank car (Option 3). Other than tank shell thickness, all other features of newly built tank cars would be identical, regardless of commodity.

Although we support a 9/16 inch thick tank shell for new tank cars entering crude oil and ethanol service, we note that increasing shell thickness will never make a tank car completely immune to the forces present in high energy derailments. One way to examine the performance difference between tank cars with 9/16 inch shell thicknesses and tank cars with less than 9/16 inch shell thicknesses is to compare the predicted puncture speed of the 9/16 inch design configuration proposed in Options 1 and 2, as compared to the speed of the derailed cars from the Lac Mégantic tragedy. The NPRM estimates a car with 9/16 inch thick tank shell would experience puncture from a 12 inch x 12 inch indenter with a weight of 297,000 pounds at a speed of 12.3 mph.[14] Using 12.3 mph as the threshold speed at which a car with a 9/16 inch thick tank shell would puncture in a derailment, one can look at the hypothetical effect the Option 1 car configuration would have had on the Lac Mégantic event. Exhibit A2 shows the derailment speed of all cars that derailed at Lac Mégantic, with additional annotations. Therefore, hypothetically, if all derailed cars in the Lac Mégantic event would have had 9/16 inch thick shells, only one additional tank car out of fifty-nine breached tank cars would have survived the incident.

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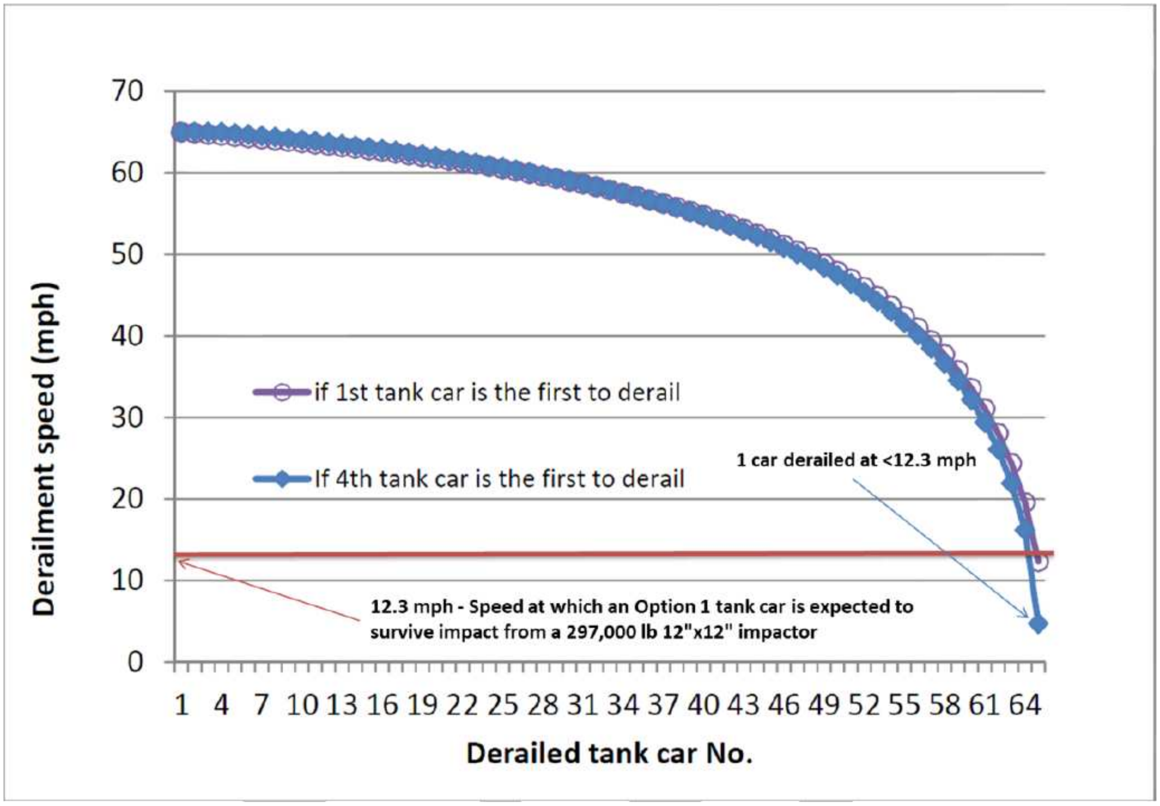
14 79 Fed. Reg. 45054, Table 18 and FN 58.

Exhibit A2[15]



B. The RSI-CTC Supports a Thermal Protection System for New Tank Cars that Satisfies the 100-minute Pool Fire Requirement

We support the requirements contained in the Proposed Regulations that all new tank cars meet the 100-minute pool fire and 30-minute torch fire survivability standards. For newly built tank cars to meet these requirements, the RSI-CTC recommends a thermal protection system consisting of: application of a steel jacket, a high temperature thermal blanket and an appropriately sized PRV. Although thermal blankets are not necessarily required to achieve effective thermal protection, the RSI-CTC believes them to be cost-effective and most beneficial to the overall thermal protection system.

C. The RSI-CTC Supports Top Fittings Protection but Opposes Rollover Protection as a Requirement for New Builds

Both top fittings and rollover protection are intended to prevent loss of lading in a derailment scenario. To date, only top fittings protection has been used in general purpose tank cars, with rollover protection being deployed exclusively in pressure tank cars primarily carrying toxic by inhalation hazard materials ("TIH"). The RSI-CTC supports a requirement that new tank cars be equipped with top fittings protection consistent with AAR Specifications for Tank Cars, Appendix E, paragraph 10.2.1 (CPC-1232 standard) instead of TIH rollover protection because: 1) top fittings protection has

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15 Transportation Safety Board of Canada, Engineering Laboratory Report (LP039/2014), (April 3, 2014).

proved to be suitable for addressing lading losses in derailments involving general purpose tank cars and 2) rollover protection is largely unproven in the general purpose tank car context, likely will add only slight safety benefits to such tank cars, and may have unintended negative structural and commercial consequences.

Recent findings published by Canada's Transportation Safety Board ("TSB") suggest the current CPC-1232 industry standard for top fittings protection on general purpose tank cars already accomplishes its intended purpose of substantially reducing top fittings breaches in derailment scenarios. As stated in the TSB report on Lac Mégantic, "approximately 15% of the cars with impact-damaged top discontinuity protection housings (CPC-1232 standard) had breached top fittings, whereas 62% of the cars with impact-damaged hinged housings [conventional arrangement] had breached top fittings."[16] TSB goes on to conclude "this comparison demonstrates that top discontinuity protection is effective in reducing the release of product from impact-damaged top fittings (including [pressure relief devices])."[17] Hence, for the Lac Mégantic derailment, the CPC-1232 top fittings protection standard reduced loss of ladings through fittings by a factor of four relative to the conventional arrangement.

According to research performed by Sharma and Associates for the U.S. Federal Railroad Administration ("FRA") on top fittings protection, the lading loss that did occur is difficult, if not impossible, to eliminate. As stated in the Sharma report, "severe derailments that involve high impact velocities are likely to result in fittings damage (and lading release), even when protective structures are employed."[18]

In contrast, the rollover protection described in the Proposed Regulations is designed for tank cars carrying products, such as TIH, where exceedingly small amounts of product release have a significant impact on environmental health and safety. TIH protection requires installation of a heavier, broader plate to the top of the tank car to secure the protective housings. Because the increased stiffness of this plate stresses other areas of the tank, potentially leading to unanticipated tank failure, TIH rollover protection has only been applied to tanks capable of supporting the additional stiffness associated with rollover protection—i.e. pressure tank cars having a thickness of at least 0.89 inches.[19] Such rollover protection is largely undeveloped and unproven in non-pressure tank cars.

The flammable liquids within the scope of the Proposed Regulations (including crude oil and ethanol) do not present the same risk as TIH commodities; a release of a small amount of crude oil, for example, does not pose imminent health and safety dangers. Moreover, the application of the heavy TIH rollover protection to 7/16 inch and 9/16 inch

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16 Transportation Safety Board of Canada, Railway Investigation Report No. R13D0054, "Runaway and Main-Track Derailment, Lac Mégantic, Quebec, July 6, 2013," at 109 (August 19, 2014) (hereafter "TSB Lac Mégantic Report").

17 *Id.*

18 U.S. DOT, Federal Railroad Administration, "Survivability of Railroad Tank Car Top Fittings in Rollover Scenario Derailments," DOT/FRA/ORD-06/11 at 41 (Dec. 14, 2005) (analysis performed by Sharma & Associates, Inc.) (hereafter "Top Fittings in Rollover Scenario Derailments Report")

19 Responsive to Q3 – New Tank Cars for HHFTs, 79 Fed. Reg. 45057.

tank cars will alter/increase the stresses in other areas of the tank, leading to unknown results, including potential tank failures in both derailment and normal operational scenarios.[20] Here too, research performed for FRA by Sharma and Associates indicates "[t]he structural connection of any add-on structure to the tank shell is a major limiting factor in the design of any system of protection."[21]

Further, mandating TIH rollover protection will have commercial and operational consequences for shippers. The heavier rollover protection will result in a loss of carrying capacity, forcing shippers to bear the cost of using more tank cars to carry the same amount of product. The shipping community also has indicated that TIH rollover protection on general purpose cars built with a 7/16 inch or 9/16 inch tank shell may impair a shipper's ability to load and unload the tank car.

Under these circumstances, TIH rollover protection is not justified from a safety, technical, or economic standpoint for DOT-117 tank cars. Rather, achieving the safety goals of optimal puncture and product loss protection can be best accomplished through a more effective use of added structure and weight: thicker tanks, jackets, full height head shields, top fittings protection, a PRV and a reconfigured BOV handle.

D. ECP Brakes Do Not Achieve Significant Safety Advantages in Derailment Scenarios

The RSI-CTC wants to emphasize that it does not support the requirement that new DOT-117 tank cars be equipped with ECP brakes, because ECP brakes do not offer significant safety advantages during a derailment scenario, as compared to other alternative braking systems.

In lieu of ECP brakes, we support the use of Distributed Power ("DP") or two-way End-of-Train ("EOT") braking systems that are under consideration in Option 2 and Option 3. DP is a system that provides control of a number of locomotives dispersed throughout a train from a controlling locomotive located in the lead position. The system provides control of the rearward locomotives by command signals originating at the lead locomotive and transmitted to the remote (rearward) locomotives. The two-way EOT device includes two pieces of equipment linked by radio that initiate an emergency brake application command from the front unit located in the controlling locomotive, which then activates the emergency air valve at the rear of the train within one second. The rear unit of the device sends an acknowledgment message to the front unit immediately upon receipt of an emergency brake application command. We agree that a two-way EOT device is more effective than conventional brakes because the rear cars receive the brake command more quickly.[22]

Starting in April, 2014, railroads and DOT agreed that trains with twenty (20) or more loaded cars of crude oil operating on main track would be required to use either DP or

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[20] Early estimates for the application of rollover protection to a 9/16 inch shell tank car increase the tank car weight by 1100 lbs. and may increase cost by $4,500. Responsive to Q2 – New Tank Cars for HHFTs, 79 Fed. Reg. 45057.

[21] Top Fittings in Rollover Scenario Derailments Report at 41.

[22] NPRM, 79 Fed. Reg. 45048.

EOT systems. As a result, DP and EOT systems are already providing safety benefits, as compared to the utilization of ECP brakes which are years from operational effectiveness. As PHMSA has accurately explained in the Proposed Regulations, EOT brake performance is nearly equivalent to DP brake performance. Furthermore, Figure 1 and Figure 2 of the NPRM, shown below, demonstrate that ECP brakes are not appreciably superior to DP brake performance. Based on these figures, ECP brakes present very little advantage for the first 10 cars in a derailment and only 18% advantage, as compared to an EOT device.

Figure 1: Kinetic Energy vs. Position in Train at a Derailment Speed of 40 Mph

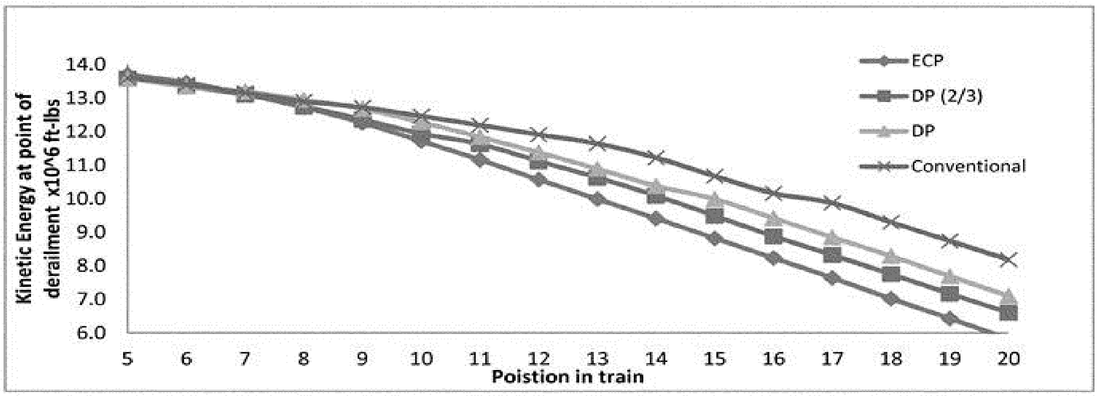
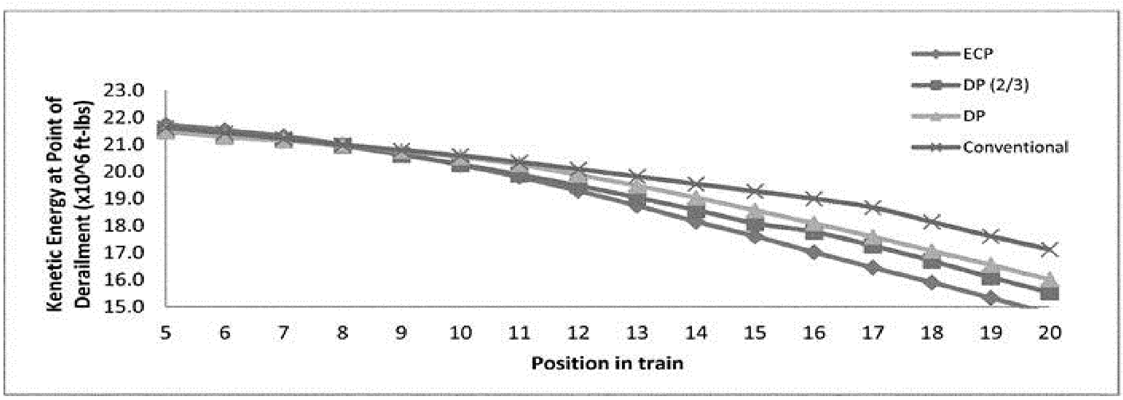


Figure 2: Kinetic Energy vs. Position in Train at a Derailment Speed of 50



Unlike DP and EOT systems, ECP technology only works if the entire train (railcars and locomotives) is equipped with ECP technology. Since the tank cars covered by the Proposed Regulations would not always move in an ECP capable train, car owners would be required to install a system that would allow tank cars to be used in both ECP and conventional braking service. Such dual systems are commonly referred to as "overlay" systems. More importantly, information available on crude oil train incidents indicates that the use of ECP brakes would have had no impact on preventing these incidents.[23] Furthermore, the AAR T87.6 task force reviewed derailment simulations

[23] *See* John Rimer, CSX Transportation, "Braking Systems and Distributed Power," (June 10, 2014), Presented to the U.S. White House Office of Management and Budget

involving ECP brakes compared to conventional braking systems and concluded that "the alternatives considered provided marginal benefits."[24] If the U.S. is seeking to achieve the greatest benefits as quickly as possible to improve safety, it should mandate the uniform use of DP or EOT braking systems.

Currently there is no infrastructure available for the testing and repair of ECP brakes at tank car shops or on railroad rip tracks and classification yards.[25] Railroads, certified tank car facilities and mini shops that perform tank car brake inspections and repairs will need additional equipment and training to perform the required testing and repair. Effectively all individuals involved in brake repair and testing in North America will require ECP test equipment and training. There will also be a need for replacement parts, such as special batteries, that are not in the current replacement parts system. These requirements will likely increase out of service time and the total cost to operate ECP equipped tank cars in excess of the costs indicated in the NPRM. The RSI-CTC disagrees with PHMSA's estimates that ECP brakes cost $3000 per new tank car and $5000 per modified tank car. PHMSA's estimates appear to fail to account for installation costs, such as labor, and parts, like pipes to protect the electrical cables and installation brackets. Based on a survey of ECP brake component suppliers, the RSI-CTC estimates the actual incremental cost of ECP brakes with an overlay system to be $7,300 for new cars and $7,800 for modified cars.[26]

VIII. Existing Tank Cars: The RSI-CTC Supports Option 3 for the Modification Requirements for the Existing Tank Car Fleet

Although the RSI-CTC supports Option 2 for newly built cars used to transport crude oil and ethanol, we do not feel that the Option 2 requirements are appropriate for existing cars under the circumstances. This is primarily due to the safety, engineering, and economic consequences associated with applying a jacket that is thicker than 11 gauge to an existing tank car, as discussed in Section VIII.E. below. Moreover, as set forth in Section VI above, it is neither necessary nor efficient for existing cars to be modified to the same requirements as new car builds.

Instead, the RSI-CTC supports most of the elements of the prescribed requirements for new tank cars set forth in Option 3 of the Proposed Regulations for existing tank car modifications, with an exception for existing tank cars carrying Class 3, PG III commodities. Specifically, we propose that modified tank cars be able to utilize the existing head and shell as a base, and we agree that the modification should include jackets, full height half inch head shields, the reconfigured BOV, a reclosing PRV, and a thermal protection system in accordance with 49 C.F.R. § 179.18.

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by the Association of American Railroads, available at http://www.reginfo.gov/public/do/viewEO12866Meeting?viewRule=false&rin=2137-AE91&meetingId=212&acronym=2137-DOT/PHMSA ("handout 2").

[24] T86.7 Task Force Report at 14, available at www.regulations.gov, Docket No. PHMSA-2012-0082-0012.

[25] Responsive to Q1 – Alternative Brake Systems, 79 Fed. Reg. 45051.

[26] Responsive to Q2 - Alternative Brake Systems, 79 Fed. Reg. 45051.

Further, we endorse PHMSA's conclusion that top fittings protection should not be included within the required modifications, because it is not justified at a cost of $24,500 per tank car. And, as indicated below, the RSI-CTC strongly recommends that PHMSA no longer remain silent on the issue of normalized steel and make clear that such steel is not, and should not be, a modification requirement. This would allow existing tank cars originally constructed with non-normalized steel to remain in service once modified. As described in sub-part F below, we support a more limited set of modifications for existing tank cars transporting Class 3, PG III commodities.

A. PHMSA is Correct that Top Fittings Protection is Not a Cost Justified Modification for Existing Tank Cars and May Introduce Unintended Safety Risks

For existing cars, the RSI-CTC agrees with PHMSA's assessment that the costs associated with top fittings protection modifications are not supported by the corresponding benefits.[27] As compared to new car builds, modification of existing tank cars to include top fittings protection is very expensive and complex. We estimate the cost of adding CPC-1232 top fittings protection to existing tank cars could be as high as $24,500 per tank car.[28] Moreover, this costly "fix" would be intended to address a "problem" even DOT acknowledges is of relatively small magnitude. Specifically, DOT has concluded that losses from top fittings damage are approximately nineteen (19) times less than those from head and shell damage.[29]

Statistical accident data corroborates the relatively minimal benefit of applying top fittings protection to existing cars. Based on studies performed within the RSI-AAR Tank Car Safety Project, the conditional probability of release ("CPR") of the non-jacketed legacy car is 0.1955.[30] The CPR after adding a jacket and full height head shield is 0.0777, for an incremental CPR improvement of sixty percent (60%). The CPR after adding top fittings protection to the jacketed and full height head shield modified car is 0.0457, providing only twenty percent (20%) of the incremental benefit. Thus, the vast majority of improvement comes not from applying top fittings protection but from adding a jacket and full height head shields to protect the shell. This makes sense, as the shell is the most common area from which commodity is released if a tank car breaches in a derailment.

Finally, the only marginal benefit of top fittings protection for existing tank cars is supported by the calculated aggregate effectiveness rates of modification options presented in the table on page one of the PHMSA technical supplement titled

27 *See* NPRM, 79 Fed. Reg. 45058. This section is responsive to Q11 – Existing Tank Cars for HHFTs, 79 Fed. Reg. 45061.

28 This is consistent with the PHMSA's cost/benefit analysis of this feature. *See* NPRM, 79 Fed. Reg. 45058.

29 *See* NPRM, 79 Fed. Reg. 45055.

30 For CPR estimates cited in this section see RSI-AAR Railroad Tank Car Safety Research and Test Project, Preliminary Report Ra-13-04A, at p. 3, Table 1, Column 3 (November 3, 2013) (TWP-17 for mainline/siding derailments with CPR values for commodity released greater than 100 gallons).

“Calculating Effectiveness Rates of Tank Car Options.”[31] The report determined that top fittings protection accounted for an aggregate effectiveness rate of only 1.3, or 3.1% of the total effectiveness of a comparably equipped Option 3 tank car. By contrast, should it be mandated, top fitting protection would account for approximately 30% of the total modification cost of a non-jacketed legacy DOT-111 tank car to meet Option 3 requirements.[32]

Modifying legacy cars to meet the CPC-1232 standard of top fittings protection could also introduce unintended safety risks. Such modification would require substantial cutting, grinding, and welding on the existing tank car structure. By their nature, these activities tend to weaken the structural integrity of the tank and are only undertaken when absolutely necessary. Overhead welding specifically would be required to secure the steel plate that would serve as the base for the modified top fittings protection to the top portion of the existing tank car. Ideally, to avoid the welder having to work against gravity, the entire tank car would be rotated upside for this welding to be performed in a downhand position. Many repair facilities are not presently equipped with the heavy machinery required to rotate the tank car. Regardless, such extensive work could introduce defects that result in fatigue cracking or otherwise cause premature tank failure—problems of far greater impact than the damage caused by relatively small and infrequent releases that occur through top fittings during derailments.

Given the above, including top fittings protection within the scope of mandated modifications for existing cars is neither warranted nor justified. We respectfully urge PHMSA to work closely with Transport Canada to harmonize this aspect of the Proposed Regulations to ensure that a top fittings modification requirement is not included for existing tank cars remaining in Class 3 Flammable Liquids service.

We note that current AAR rules require all DOT class non-pressure tank cars ordered after December 31, 2003 weighing in excess of 263k Gross Rail Load (“GRL”) to be equipped with top fittings protection in accordance with Appendix E, paragraph 10.2.[33] Under this rule, all new builds are required to have top fittings protection consistent with this provision. It is expected that any existing cars that are modified to operate at 286k GRL would need a waiver from the AAR to allow the cars to operate without having to comply with this rule. In the event that a waiver is not granted, requiring top fittings modifications will increase the number of tank cars that we expect to be retired prematurely and/or scrapped rather than modified. It will also amplify the unintended consequences associated with removing a large portion of the fleet cars service. The RSI-CTC is already in the process of seeking this waiver from AAR, and we encourage PHMSA to support the RSI-CTC in this endeavor.

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31 DOT Report, “Calculating Effectiveness Rates of Tank Car Options,” (August 25, 2014), www.regulations.gov, PHMSA-2012-0082-0180.

32 It was not previously possible to incorporate these changes without government approval.

33 AAR MSRP Section C-III (Specification for Tank Cars), Paragraph 2.5.

B. It is Critical that PHMSA Clarify that Normalized Steel is Not A Modification Requirement for Existing Tank Cars

While the RSI-CTC supports the use of normalized steel for new builds, we do not support this as a modification requirement for existing cars. Although the NPRM is silent on this point and we understand from discussions with PHMSA personnel that the agency does not intend to make this a modification requirement, it presently is included within the scope of the TC Proposed Regulations. The RSI-CTC wants to emphasize the implications of such a requirement, should PHMSA be reconsidering it at this point.

First, it is not technically possible to modify a tank car to the standard of normalized steel if the tank car was not originally constructed with such material. Of the population of existing tank cars owned by the RSI-CTC members that are potentially eligible for modification, 47,300 were manufactured from non-normalized steel. Most of these cars were constructed to carry 263k GRL and built in accordance with then-existing regulations which did not require normalized steel. The remaining 44,100 legacy DOT-111 tank cars eligible for modification for 286k GRL service were constructed of normalized steel. The existing CPC-1232 tank cars were all built with normalized steel, per the current regulations. Therefore, if normalization were included as a modification requirement, 47,300 tank cars with non-normalized steel would become obsolete, resulting in their being forced into early retirement.[34]

Second, there is no compelling safety justification to support normalized steel for modified cars. During its investigation of the Lac Mégantic derailment, the TSB Engineering Branch concluded that "there was no indication that the use of non-normalized steels for some of the tanks was a contributing factor to the product release in this derailment."[35] Data compiled by the RSI-AAR Tank Car Safety Project does not show a performance improvement in derailments when comparing normalized steels to non-normalized steels.

In further support of its position, the RSI-CTC retained independent technical expertise to assist in analyzing the implications and benefits of normalized steel. The results of this analysis indicate that the requirement to normalize is not justified from an engineering perspective or based upon the study of past accidents.[36]

The development of brittle fracture has evoked concern regarding tank car structure performance which has led to the presumption that normalized TC-128B steel would preclude brittle fracture as compared to the higher brittle to ductile transition temperatures on non-normalized A516-Grade 70 and non-normalized TC-128B steel.

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[34] As discussed in Section X.A and B, the RSI-CTC does not believe there are many other commodities whose density, shipment volumes, and packaging requirements would be suited to the use of re-purposed crude oil or ethanol tank cars. We also disagree that these tank cars would be repurposed to serve heavy crude oil from Western Canada.

[35] TSB, Operational Services Branch, Engineering Laboratory Report LP149/2013 at 30 (March 21, 2014).

[36] "Investigative Report: Fracture Behavior of Tank Car Steels," Prepared by ESI for the Railway Supply Institute (September 15, 2014).

These assumptions are not correct for a number of reasons. First, service experience suggests that brittle fracture is not significantly higher in non-normalized cars versus normalized tank cars. Second, tank cars are constructed to favor deformation rather than fracture, so that the tank steel yields easily when impacted. Third, bi-axial stress fields occur more frequently than tri-axial stress fields required for brittle fracture. Fourth, tank cars are built with a "clean" vessel design with few "hard" points, which means they are more likely to experience ductile tearing instead of a brittle fracture.

C. The RSI-CTC Supports a Thermal Protection System for Existing Tank Cars that Satisfies the 100-minute Pool Fire Requirement

We support the requirement that all existing tank cars must meet the 100-minute pool fire and 30-minute torch fire survivability standards, which are in the Proposed Regulations. The RSI-CTC contends that the thermal protection systems utilized to meet these standards should differ, however, depending on whether the existing car is non-jacketed or jacketed.

Our recommendations are based upon the results of a number of Analysis of Fire Effects on Tank Cars ("AFFTAC") simulations. AFFTAC is a fire simulation software tool which FRA has previously accepted as a means to verify existing thermal protection performance standards for tank cars currently operating. The simulations were performed for a range of flammable liquid commodities, including crude oil and ethanol. With respect to crude oil specifically, the RSI-CTC worked with the American Petroleum Institute ("API") to verify the thermodynamic properties of several grades of crude oil, including that from the Bakken region.[37] Accordingly, these properties were used as inputs in the AFFTAC simulations. Thermal protection systems consisting of glass wool insulation (in the degraded condition) or high temperature thermal blankets were accounted for, as were several PRV configurations. The tank car geometry inputs are representative of both the existing tank car fleet as well as current proposals from both PHMSA and Transport Canada. Using the scenarios described below, the AFFTAC simulation results indicate tank cars in all flammable liquids service will survive in excess of 100 minutes in a pool fire and 30 minutes in a torch fire if equipped with the RSI-CTC recommended thermal protection systems.

1. Existing Non-Jacketed Tank Cars

For existing non-jacketed tank cars (both legacy DOT-111s and CPC-1232s), the RSI-CTC recommends application of a steel jacket, high temperature thermal blanket, and properly sized PRV.[38] These elements will work together to form a thermal protection system appropriate for cars originally constructed without jackets. Although thermal blankets are not necessarily required to achieve effective thermal protection, the RSI-CTC supports their use in this situation as a cost-effective means to enhance the benefits of the overall thermal protection system. The only caveat is that with respect to

[37] API Crude Oil Physical Properties Ad-Hoc Group, "Predicted Effects of Crude Oil Properties on Railroad Tank Car Survival in a Pool Fire," (June 24, 2014).

[38] As stated below in Section VIII.F., all existing tank cars serving Class 3, PG III commodities would satisfy the thermal protection system requirement by application of an appropriately sized PRV. Accordingly, legacy DOT-111s in Class 3, PG III service would not be equipped with jackets or full height head shields.

non-jacketed CPC-1232s, we do not recommend the application of a high temperature thermal blanket under the side ladder area, as it will create clearance problems. Since a thermal blanket will still be applied to the remaining area of the tank shell, the RSI-CTC believes this will result in minimal adverse safety impact.

2. Existing Jacketed Tank Cars

For the existing fleet of jacketed tank cars, the RSI-CTC recommends a thermal protection system consisting of a properly sized PRV in addition to the existing glass wool insulation and steel jacket. The difference between this proposed modification and that for the non-jacketed cars is the use of glass wool insulation vs. a thermal blanket. In this situation, we believe that the application of a thermal blanket is of limited safety benefit compared to the high costs of application. Here, unlike the situation with non-jacketed cars, the existing jacket would need to be removed before the thermal blanket could be installed and the jacket then reapplied. This process is labor-intensive and expensive. Significantly, the RSI-CTC's engineering analysis indicates that the existing fleet of jacketed tank cars can meet the fire survivability standards even without a high temperature blanket by using glass wool insulation and the PRV instead.

The presence of the jacket alone provides a radiation "shielding" effect that protects the tank from direct exposure to fire conditions. And, although the glass wool insulation degrades under fire conditions, FRA tests[39] have shown that the residual insulation still retains some level of insulating properties. The occurrence of a thermal tear on a tank car insulated with glass wool insulation is an extremely rare event with only two documented cases occurring over the last 30 years of accident experience. In conjunction, these two components substantially limit thermal exposure.

To further mitigate the effects of heat exposure, the PRV can be sized and configured to minimize pressure build-up in the tank, thereby further reducing the potential for a high energy event. When sized properly, the PRV will provide only the necessary release of commodity to accomplish this. Hence, the steel jacket, glass wool insulation, and a properly sized PRV, in combination, provide an effective tank car thermal protection system.

3. Existing Tank Cars in Class 3, PG III Service

For existing tank cars transporting PG III flammable liquids other than crude oil and ethanol, the RSI-CTC recommends only the addition of the PRV to satisfy the thermal protection system requirement. These commodities have higher flash points which reduce the likelihood they will cause or contribute to a fire. Should they be subjected to fire conditions, a properly sized PRV provides adequate thermal protection.

D. Truck Upgrades Will Be Necessary for Most DOT-111 Legacy Tank Cars

In the Proposed Regulations, PHMSA assumes that legacy DOT-111 tank cars will be able to withstand the additional weight of the proposed modification without truck

[39] Wright, William P, Slack, Wayne A, Jackson, Willis F, "Evaluation of the Thermal Effectiveness of Urethane Foam and Fiberglass As Insulation Systems For Tank Cars," US Army Laboratory Command, July 1987.

replacement.[40] This is based largely on PHMSA's belief that the majority of tank cars in crude oil and ethanol service were built within the past 15 years, and therefore were already built to operate at 286k GRL with trucks that would support the additional weight.[41] This assumption is incorrect. In reality, some level of truck modification will be required for nearly all legacy DOT-111s and the cost associated with this work is substantial.

Based on the Proposed Regulations and consistent with the RSI-CTC's position, legacy DOT-111s in crude oil and ethanol service will be modified to include the addition of full-height head shields. Additionally, jackets and thermal blankets will be applied to the non-jacketed DOT-111s along with other protective features. These added features will increase the tare weight (i.e. the weight of the empty tank car) of a 30,000 gallon non-jacketed DOT-111 tank car by a minimum 13,000 pounds (or more depending on the final regulatory requirements).[42] As the NPRM indicates, to offset the increase in tare weight and to prevent a loss of shipping capacity, the GRL of the tank would need to be increased from 263k GRL to 286k GRL during the modification process.

AAR Office Manual Rule 88[43] states that freight cars operating at the increased 286k GRL must be in compliance with AAR MSRP S-286, which in turn provides the specifications for roller bearings, axles and adaptor—which requires new components in order to operate at 286k GRL.[44] Even if an existing legacy DOT-111 tank car had been built with the appropriate truck castings,[45] all four wheel sets on that car would still need to be replaced during the modification process to comply with existing AAR rules. New wheel sets are an additional cost of approximately $10,000 per tank car.

The AAR interchange rules further require that trucks be of an M-976 approved design.[46] While some existing legacy DOT-111s have truck systems with castings that could be reconfigured to match an approved truck design, the majority of these tank cars would require completely new truck systems, because the original ones cannot be reconfigured to match an approved design.[47] Most legacy DOT-111s will require, at a minimum, new

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[40] NPRM, 79 Fed. Reg. 45059. This section is responsive to Q7 – Existing Tank Cars for HHFTs, 79 Fed. Reg. 45061.

[41] *Id.*

[42] The 30,000 gallon non-jacketed tank car is used as the most common, but not the only, type of modified tank car impacted by the increased GRL requirements.

[43] *See* AAR Office Manual Rule 88, Section C.1.e(1).

[44] AAR MSRP S-286 requires trucks to have 6 ½ inch x 9 inch, 7 inch x 9 inch, or 7 inch x 12 inch roller bearings (Section 2.3) and new axles (Section 2.4) along with various other requirements.

[45] Many legacy DOT-111 tank cars were built for 263k GRL service with 6 ½ inch x 9 inch roller bearings, which is one of the AAR MSRP S-268 compliant roller bearing specifications.

[46] *See* AAR MSRP S-286, Section 2.8.1.

[47] The M-976 approved truck designs are listed in Table 2 of the AAR Field Manual Rule 46. Some existing truck systems may be reconfigured to conform to one of these

wheel sets and, in some cases, additional truck components. Others will also require new side frame and bolster castings. This truck work will cause a spike in demand for wheel sets, truck castings, and other truck hardware. The number of tank cars that can be modified would be limited if there is a shortage of any of these materials.

The RSI-CTC will seek a waiver from the AAR to allow legacy DOT-111s to operate at 286k GRL without having to replace the wheelsets. If this waiver is granted, then those tank cars with trucks capable of reconfiguration to an M-976 approved design would be modified by adding specific new components such as steering adaptor technology. However, the cost would be substantially reduced because entire new wheel sets would not be required. If the waiver is not granted, then the new wheel sets must be included as an additional modification cost. It simply would not be economically feasible to continue to operate the modified legacy tank cars with the additional weight at anything other than 286k GRL due to the decrease in carrying capacity. The absence of a waiver would also lead to additional tank car retirement beyond the 28% estimated by the RSI-CTC, which is discussed in more detail in Section IX.A. *See* Appendix B for specific costs associated with truck upgrades with and without a waiver.

E. Consequences of Requiring a Thicker Tank Car Jacket

In the NPRM, PHMSA asks how existing tank cars would comply with the requirement for an additional 1/8 inch thickness, should the agency select Option 1 or 2 as the modification requirements.[48] As delineated below, the RSI-CTC does not believe that this is a concept that ultimately merits serious consideration.

The only way for cars built with tank shells less than 9/16 inch to meet the thickness requirement of Option 1 or 2 is by adding additional thickness through the jacket material. However, a thicker jacket would require steel that is less flexible and more difficult to conform to the contour of a tank car. Roll forming would be required to fit the thicker jacket to the tank car, a process that occupies a great amount of physical space and requires specialized heavy equipment. Today, this process is rarely performed outside the existing railcar manufacturing sites in North America. In order to accommodate the demands of a mandated modification under the Proposed Regulations, the few repair shops with sufficient physical capacity to add the thicker jackets would need to undertake the significant capital investment necessary to procure the appropriate equipment to perform the required work.

Additionally, fabrication of the thicker jacket will require modified welding practices that go beyond those required for standard jacket fabrication. Only the most experienced welders would likely be qualified to complete such work. Anchoring the jacket to the car will also be problematic. The heavier the jacket, the more prone it will be to shifting caused by impacts during regular train operations. The tank nozzle is the primary anchor point for jackets. Increasing the weight of the jacket may require the tank nozzle to be reinforced at the tank. This could adversely affect the performance of the nozzle to tank connection in a derailment.

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designs through the addition of certain truck system elements such as steering adapter pads, additional load springs, or friction wedges. See Appendix B for component costs.

[48] NPRM, 79 Fed. Reg. 45061 (responsive to Q6 - Existing Tank Cars for HHFTs).

The increased thickness will increase the weight of the jacket and further reduce the carrying capacity of the legacy cars should they not be able to operate at a GRL above 263k. The additional weight of the jacket may also introduce stresses that reduce the fatigue life in other areas of the tank. And, if a thicker jacket is mandated, there is a risk that lighter gauge jacket materials could be used on repairs to avoid having to roll form replacement sections. This may undermine the integrity of the jacket itself.

Finally, as stated previously, based on studies performed within the RSI-AAR Tank Car Safety Project, the CPR(100) of the jacketed and full height head shield CPC-1232 tank car is 0.0457; whereas, the jacketed and full height head shield CPC-1232 built with a ½ inch thick tank is 0.0365 and the jacketed and full height head shield CPC-1232 built with a 9/16 inch thick tank car is 0.0293. This means that if 100 CPC-1232s with a 7/16 inch tank were derailed in FRA-reportable accidents, we would expect approximately 4 or 5 of them to release more than 100 gallons of lading, whereas if all 100 cars were built either with a ½ inch thick tank shell or a 9/16 inch thick tank shell then we would expect about 3 to 4 of them to release more than 100 gallons. Thus, increasing the shell thickness from 7/16 inch to either ½ inch or 9/16 inch would only reduce the amount of breached cars by approximately 1 car on average. In contrast, the same data shows that the vast majority of improvement comes from adding a jacket and full height head shields to protect the shell where the commodity is most commonly released if tank cars breach in a derailment.

For these reasons, we strongly recommend that PHMSA permit existing tank cars built to 7/16 inch thickness to remain in service without requiring these tank cars to meet an increased shell thickness requirement. There are several risks associated with adding a thicker jacket to these tank cars which outweigh the safety benefit that may be associated with a thicker jacket.

F. Limited Modifications for Existing Tank Cars in PG III Service

The RSI-CTC respectfully suggests that a separate approach be taken with respect to modification of existing tank cars transporting Class 3, PG III commodities.[49] The transportation of Class 3 PG III flammable liquids does not warrant the same tank car packaging requirements as those needed for transport of Class 3 PG I and II commodities. PG III commodities have less hazardous characteristics (typically higher flash points) than crude oil, ethanol and other PG I and II commodities and do not generally move in either the volume or density as experienced with crude oil or ethanol. PG III commodities have been transported safely over many years in cars meeting existing regulatory requirements. Given the lower risks associated with transporting PG III commodities, the RSI-CTC recommends that changes to requirements for existing tank cars transporting PG III commodities be limited to the application of a reconfigured BOV and a reclosing PRV. Application of these features is an effective way to reduce the amount of product released and prevent high energy events if these cars are impacted by a derailment. Moreover, BOV and PRV modifications can be performed at the time of scheduled requalification, allowing the industry to direct its limited modification resources to those tank cars transporting commodities that typically move in unit trains.

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[49] This section is responsive to Q1 – Inclusion of PG III Materials, 79 Fed. Reg. 45062.

IX. PHMSA's Proposed Modification Timeline Cannot be Achieved Based on Repair Network Facility Constraints and Does Not Account for Several Unintended Consequences

Under the Proposed Regulations, PHMSA would require that all modifications for all legacy DOT-111s and CPC-1232 tank cars in PG I service be completed by October 1, 2017, only 36 months from now. Roughly 50,000 of these tank cars (the "NJ Legacy Cars") are non-jacketed legacy DOT-111s in crude oil (23,000) and ethanol (27,000) which will require the full package of modifications to achieve compliance with the Proposed Regulations. At this time, it is nearly impossible to determine how many of these are PG I versus PG II because only the lessee (i.e. the shipper) has absolute knowledge of what commodity is shipped in the tank car. Therefore tank car owners and manufacturers would have to assume that all tank cars in this commodity service would be required to undergo modification or be removed from service to comply with the deadlines.

Based on the RSI-CTC's survey of maintenance and repair shop capacity currently expected to be available for completing these extensive modifications, only approximately 15,000 of the NJ Legacy Cars can realistically be modified by the proposed October 1, 2017 deadline. The RSI-CTC estimate of shop capacity assumes a ramp-up period of approximately six months for existing facilities, following the issuance of a final, non-appealable rule to allow for facility configuration, material procurement and workforce acquisition/training. We further estimate that because of technical barriers to modification, twenty-eight percent (28%) of the legacy DOT-111s, or approximately 25,600 tank cars, will be retired early from crude oil, ethanol and other flammable liquids service, rather than undergo modification.

A. Recommended Timeline[50]

In order to accommodate the complexities and concerns identified in the sections below, the RSI-CTC has developed a timeline for the required modifications which is both aggressive and achievable. This timeline assumes the following:

- A final rule, no longer subject to legal challenges, would be in place by January 1, 2015.
- The compliance schedule includes a ramp-up period of a minimum of 6 months following the publication of a final rule to allow time to order materials, component parts, certify and train skilled labor, etc.
- Most manufacturing and repair facilities would not perform modifications until after the 6 month ramp-up period.
- Manufacturing and repair facilities are operating at an estimated capacity of 6,400 cars/year in year two of the modification program.[51]

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[50] This section is responsive to Q5 – Existing Tank Cars for HHFTs, 79 Fed. Reg. 45061.

[51] The RSI-CTC estimated the annual modification capacity based on a survey of member companies' maintenance and repair shop capacity and those shops most frequently used by the RSI-CTC members. We also included information from the Alltranstek survey conducted by API. Each company was asked to estimate the capacity

- The estimated population of modified cars accounts for a 28% early retirement rate applied equally to jacketed and non-jacketed legacy DOT-111s.

Legacy DOT-111 Crude Oil and Ethanol Tank Cars: All legacy (jacketed and non-jacketed) tank cars transporting crude oil (all Packing Groups) would be modified or removed from crude oil and ethanol service by **December 31, 2020**. This would require modification of approximately 36,000 non-jacketed legacy tank cars and 5,100 jacketed legacy tank cars. In the event a final rule is not in place by January 1, 2015, then the compliance period would be 72 months after publication of a final rule.

Non-Jacketed CPC-1232s Crude Oil and Ethanol: All non-jacketed CPC-1232 tank cars transporting crude oil and ethanol (all packing groups) would be modified or removed from crude oil and ethanol service by **December 31, 2022**. This would require modification of approximately 22,000 tank cars in crude oil service and 750 tank cars in ethanol service. In the event a final rule is not in place by January 1, 2015, then the compliance period would be 96 months after publication of a final rule.

Legacy DOT-111s in Class 3, PG I & II Service: All legacy (jacketed and non-jacketed) tank cars transporting Class 3 Packing Group I and II materials other than crude oil and ethanol would be modified or removed from Class 3 PG I and II service by **December 31, 2025**. This would require modification of approximately 14,300 non-jacketed tank cars and 5,400 jacketed tank cars in other flammable liquids service. In the event a final rule is not in place by January 1, 2015, then the compliance period would be 120 months after publication of a final rule.

Jacketed CPC-1232s in any Class 3, PG I & II Service: All jacketed CPC-1232 tank cars transporting Class 3 PG I and PG II materials (including crude oil and ethanol) would be modified at next shopping event or requalification, whichever occurs first, but no later than **December 31, 2025**. This would require modification of approximately 1,580 tank cars in other flammable liquids service. In the event a final rule is not in place by January 1, 2015, then the compliance period would be 120 months after publication of a final rule.

Legacy DOT-111s in Class 3, PG III Service: All legacy DOT-111 tank cars transporting Class 3 PG III materials would be modified at next shopping event or requalification, whichever occurs first, but no later than **December 31, 2025**. This would require modification of approximately 4,925 tank cars in other flammable liquids service. In the event a final rule is not in place by January 1, 2015, then the compliance period would be 120 months after publication of a final rule.

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expected to be available for completing these extensive modifications based on the RSI-CTC's proposed modifications. Our members provided a range of capacity projections. We have used the 6,400 figure here to illustrate a more realistic approach, but our recommended compliance deadlines assume some additional growth in annual modification capacity will occur.

Exhibit A3: Modifications by Existing Tank Car Sub-fleet

Sub-fleet	Number of Tank Cars (Adjusted for 28% early retirement)	Deadline for Modification	Modifications Required
NJ Legacy DOT-111s	16,625 (crude oil) 19,467 (ethanol) 14,279 (other FL, PG I & II)	12/31/2020 12/31/2025	Full-height head shield, Jacket, Thermal Protection System, Reclosing PRV, Reconfigured BOV, Increase to 286k GRL
J Legacy DOT-111s	5,052 (crude oil) 63 (ethanol) 5,421 (other FL, PG I & II)	12/31/2020 12/31/2025	Full-height head shield, Thermal Protection System, Reclosing PRV, Reconfigured BOV, Increase to 286k GRL
NJ CPC-1232s	21,993 (crude oil) 751 (ethanol) 2,395 (other FL, PG I & II)	12/31/2022 12/31/2025	Jacket, Thermal Protection System, Reclosing PRV, Reconfigured BOV
J CPC-1232s	35,608 (crude oil) 23 (ethanol) 1,580 (other FL, PG I & II)	12/31/2025	Thermal Protection System, Reclosing PRV, Reconfigured BOV
All existing tank cars in PG III Service	4,925 (FL, PG III only)	12/31/2025	Reclosing PRV, Reconfigured BOV

We also suggest including progress intervals and reporting requirements for modification compliance, particularly for those cars that must be modified or retired before the 2020 (i.e. 72 month) deadline. This approach was utilized when FRA mandated that reflectors be applied to new and existing tank cars.

B. The Modification Timeline Must Account for the Limited Resources and Practical Constraints of the Maintenance and Repair Facility Network

Tank car modification is an extremely complex process that requires numerous engineering, safety and mechanical activities to occur both in preparation for and after the application of the features required by the Proposed Regulations. This section discusses: 1) the complexity of the modification process; 2) practical constraints on the maintenance and repair facility network; and 3) the challenges associated with bringing a new "greenfield" facility online.

1. Complexity of Large Scale Modifications

a. Prior to Modification

Preparing a tank car to undergo the modifications contemplated by the Proposed Regulations involves numerous steps that must occur when the car arrives at a repair facility. Upon entry, the tank car must be visually inspected and assessed for any damage requiring repair. Next, the tank car must be steam cleaned to remove all commodity residue. Crude oil cars may then require a more involved process including manual labor to scrape commodity heels from the tank interior, followed by a chemical wash or second steam cleaning. Cars with corrosion or rust may require a commercial grade interior blast to make the tank suitable for interior inspection and repair. Once clean, facility personnel will perform a series of tests to inspect the structural integrity of the attachment welds and the underframe and to test the shell thickness. These tests determine the tank car's suitability for modification, repurposing, or scrapping.

Next, the tank car must be readied for non-modification repairs. These repairs may include draft sill repairs, draft component replacement, truck casting repairs, truck component replacement, or attachment weld repairs. After that, all valves and fittings—including the top unloading valve, the pressure relief device, the manway cover, and the fittings plate and protective housing—must be removed. The side ladders, top platform, the bottom outlet valve, and the guardrails and brackets on the underside of the tank must also be removed. Finally, the entire brake system, including the brake rigging, the hand brakes, control valves, brake pipe, brake rods, and supports would all need to be removed from the tank car. If truck upgrade is required, the road truck would be removed and the car would be placed on shop trucks to facilitate the modification of the car. Only at this point is the tank car ready to undergo modification.

b. During Modification

First, head shield supports must be welded to the ends of the tank car to support the application of a full-height head shield. These supports are then heat treated with blankets to locally stress-relieve the tank in the areas where the welding occurred. Next, the tank must be blasted and primed to create the appropriate profile for application of the thermal blanket. Blasting consists of spraying the tank with hard sand or grit at a high velocity to remove old paint and shop dirt prior to painting the tank shell to prepare it for application of the thermal blanket. It also creates a textured pattern or profile on the tank surface to allow the paint to properly adhere to the tank. Then, jacket spacers are applied to hold the jacket a certain distance from the tank to keep it from crushing the thermal blanket that rests between the jacket and the tank shell. The thermal blanket is then applied to the tank.

The jacket must then be fabricated, with the most efficient process to do this being the use of large scale rolling equipment to conform the jacket to the correct shape and semi-automatic welding equipment to weld the jacket sections together prior to application on the tank car. However, most repair facilities do not presently own or have access to this type of equipment—typically costing approximately $1 million and usually only found in manufacturing facilities suited to large scale tank car production. Accordingly, most facilities would need to manually roll and weld the sections. The interior of the jacket is then primed. Next, the head shields and jacket would be applied to the blasted and primed tank car. Re-application of the requalified top and bottom fittings and nozzles would then take place, followed by assembly and application of the new brake brackets, supports and carriers. All other external equipment that was removed prior to modification would then be reapplied to the modified tank.

c. Post-Modification

After the modifications are complete, the road trucks would be reapplied, and the tank car would undergo required testing to confirm the proper functioning of the equipment. This includes an airbrake test, qualification of the valves, a leakage pressure test, testing of the full brake system, and a curve test to check the wheel clearance. Before the tank can be returned to service, it must be painted and stenciled. The painting process typically takes 48 hours so that the cars have sufficient time to dry prior to stenciling. The tank car also must be weighed to determine the tare weight of the car so that it can be stenciled appropriately. Finally, all regulatory and registration paperwork must be completed before the tank car can be released from the facility and returned to service.

Rarely has PHMSA found need to call for such a large and complex modification program to an existing fleet of tanks such as is now proposed. In fact, the only previous ruling that comes close to the complexity now under discussion is HM-144 dating back to the late 1970's. Within that rule, certain non-insulated 114A and 112A pressure cars were to be modified by the application of full head shields, thermal insulation and metal jackets. The final rule outlined that 20,400 cars were subject to the full scope of the rule and that approximately 12,500 cars were scheduled to be modified with jackets, insulation and full head protection. The text of the rule-making documents clearly recognized the difficulty of the modification tasks called for, and for that reason, in part, specified a four-year time frame for compliance.[52] We note that the population of cars covered by the current proposal is at least four times larger, while the suggested compliance period has been cut in half.

2. Practical Constraints on the Maintenance and Repair Facility Network

In addition to the complexity of the modifications noted above, there are several practical constraints on the maintenance and repair facility network that will complicate and may delay the execution of the modification program. First, there is the fact that these modifications do not occur in a vacuum. At the same time that tank cars are entering a facility for modification, the same facility is also handling bad orders (i.e. equipment repairs), reassignments of the tank car into new commodity service, and mandatory requalifications. Based on build dates, we anticipate that the required 10-year requalifications will peak in 2017 and 2018, the same time when the most extensive modifications would be required by the Proposed Regulations. See Table 2 for the requalification schedule.

Exhibit A4: Tank Car Requalification Schedule

Year	Cars Inspected Initial Cycle [a]	Cars Built Initial 10-yr Cycle [a, b]	Cars Built Second 10-yr Cycle [c]	Total
2010	6,275	9,766	NA	15,460
2011	10,752	7,560	NA	17,854
2012	10,582	5,519	NA	15,698
2013	11,590	8,176	NA	19,272
2014	12,576	8,939	NA	20,977

52 *See* Shippers: Specification for Pressure Tank Car Tanks, Docket No. HM-144, 43 Fed.Reg. 20250 (May 11, 1978)(describing the relative difficulty of retrofit tasks); *See also* Specifications for Pressure Tank Cars, 42 Fed. Reg. 46306, 46308 (Sept. 15, 1977) (noting commenters concerns that modifications could not be allotted in the required time and extending the compliance period).

2015	12,387	11,563	NA	23,351
2016	13,097	12,075	14,034	38,226
2017	15,230	10,415	21,433	45,901
2018	15,923	12,992	21,700	49,350
2019	19,230	13,243	8,942	40,380
2020	6,275	9,766	4,837	20,356
2021	10,752	7,560	8,727	26,363
2022	10,582	5,519	17,666	32,923
2023	11,590	8,176	28,996	47,543

[a] T87.6 Task Force data.
[b] American Railcar Institute (ARCI) data.
[c] Total includes a standard 2.5 % retirement rate.

Second, there is the potential unavailability of materials and component parts. The RSI-CTC has assumed a six month ramp-up period prior to modification, but there is no guarantee that the necessary materials and parts would be delivered within that time frame. Third, the availability of skilled labor is also a factor that could impact the modification program. Many facilities anticipate hiring additional workers or adding shifts to meet the modification schedule. These complicated modifications require welders with special certifications and substantial on the job training. Fourth, PHMSA should consider that most repair facilities do not exclusively service tank cars. Many other types of freight cars require maintenance and repairs. Industries relying on other types of freight cars also need access to repair network capacity during the tank car modification program.

Finally, there are several execution risks beyond the control of the car owner that may also impact its ability to comply with the modification deadlines. To comply with the proposed timeline, such individual car owners will attempt to create balanced flows of cars from customers to repair locations and then back to customers after work is complete. They will need to mitigate and manage the risks that could cause their car flows to become unbalanced, leading to missed compliance deadlines. These risks are as follows:

- Shippers generally size their fleets for projected production volumes so that there are few excess cars in their fleets. Unless they are confident they have enough cars to meet short term production needs, shippers may hold on to cars instead of shopping them as scheduled.
- Railroad performance in moving cars to and from shops is erratic. This can cause customers to hold cars that have been scheduled for shopping and cause disruption in the flow of cars through shop work centers.
- Lack of geographic proximity between where cars are used and the location of the shops may increase costs and cause delays in getting cars to the shops.
- Projected cycle times are often longer than expected due to disruptions in staffing levels, material shortfalls and production equipment failures.

- Tank cars are frequently not in the expected condition when they arrive at a shop and often need additional repair or maintenance work. Condition issues may include excess or inaccurate commodity left in the car, additional components requiring repair, or unreported changes to the car requiring engineering review or verification.
- Tank cars will need to be shopped by Builder and Lot Numbers to the maximum extent possible to avoid the need to reconfigure the production line more often than necessary. This requires coordination of multiple customers shopping their cars at the same time or working with one large customer to shop a majority of their cars at the same time.
- Natural bottlenecks in a repair facility (most notably paint and lining) will be exacerbated by the influx of modification work, possibly leading to delay in the release of cars.
- Multiple shoppings may be required if a repair facility does not have the capabilities required to do all work needed (i.e. cleaning, mechanical (including the capability to perform requalifications), modification, paint/lining). This may increase the cycle time and complicate the logistics of the modification program.

3. Greenfield Facilities

There are significant barriers to entry into the business of performing the types of modifications set forth in the Proposed Regulations. Obtaining the requisite certifications and environmental permits alone could take well over a year. Not only does the labor force need certification to perform certain types of welding work, but the facility itself must be certified by the AAR and the Bureau of Explosives. Additionally, the cleaning and painting operations at a typical repair facility require complex air permits that must be approved by federal and state regulators. The "greenfield" cost is likely prohibitive for many potential facility owners given the significant capital investment required. This is particularly true when the most extensive modifications under the Proposed Regulations would need to be completed before October 1, 2017. In light of these barriers, it is unrealistic for PHMSA to assume an increase in capacity of the maintenance and repair network based on the addition of a significant number of new facilities.

C. New Tank Cars Cannot Begin Replacing the Existing Fleet Immediately

It is clear in the NPRM that PHMSA has assumed that the tank car manufacturing industry is in a position to begin immediately replacing existing tank cars with new builds. This assumption is incorrect and reflects a misunderstanding of the information that RSI-CTC presented to OMB during a meeting in June 2014.[53] To be clear, the backlog for new cars built to serve crude oil and ethanol will consume all available production through the end of 2015. Starting in 2016, the tank car manufacturing industry will have capacity to build approximately 20,000 new cars annually for crude oil and ethanol. The remaining new car capacity is expected to be required to meet tank car construction

[53] *See* U.S. DOT/PHMSA Draft Regulatory Impact Analysis, PHMSA-2012-0082-0179 at p. 77 (hereafter "Draft RIA").

demands for other commodities.[54] Given that the existing legacy DOT-111 crude oil and ethanol tank car fleet is over 57,000 tank cars, and that a portion of new car builds will be needed to support increased demand for crude oil transportation, it will take over 3 years to replace the existing fleet of DOT-111 cars.

Unlike the assumptions made by PHMSA, the RSI-CTC anticipates that crude oil demand will continue, resulting in additional growth of the crude oil fleet. Satisfaction of new crude oil tank car demand should, therefore, be considered alongside efforts to replace the existing DOT-111 fleet.

D. PHMSA Fails to Account for the Unintended Consequences of its Timeline

The RSI-CTC has retained The Brattle Group ("Brattle") to fully assess the economic impact of the Proposed Regulations.[55] According to Brattle's analysis, the immediate effect of the Proposed Requirements would be to force over 90,000 tank cars to be withdrawn from service at various times during the modification program and parked until the shop capacity required to carry out the necessary modifications becomes available. See Exhibit B1 for details. Brattle estimates that the total out of service time for these parked cars could amount cumulatively to over half a million car-years.

A major portion of this loss would involve cars carrying flammable liquids other than crude oil and ethanol. These commodities pose a relatively smaller risk, so under any rational modification schedule that prioritizes tank cars associated with the highest risk, these tank cars would be modified last (i.e. only after the necessary work had been carried out for the crude oil and ethanol fleets). Even among the crude oil and ethanol fleets, however, total out of service time would come to well over a quarter million car years.

Exhibit B1: Tank Cars in Crude, Ethanol and Other Flammable Liquids Service

Number of Cars Subject to Deadline	145,219
Number of Cars Modified by Deadline	25,487
Number of Cars Retired at Deadline	25,602
Number of Cars Awaiting Modification at Deadline	94,130

If PHMSA elects to follow our recommendations (outlined above) and allow jacketed CPC-1232 cars to remain in service until the necessary modifications can be carried out in conjunction with ordinary maintenance or requalification work, this figure drops to

54 These capacity figures reflect tank car manufacturing only and are not expected to impact the manufacturing of other types of freight cars.

55 Founded in 1990, the Brattle Group employs a staff roughly 200 professionals, many with advanced training and degrees, and supplements their capabilities through affiliations with leading international academics and industry specialists. Brattle provides consulting and expert testimony in economics, finance, and regulation to corporations, law firms, and governments around the world. As a result of its long-standing and extensive experience in working with regulated network industries the company has particular expertise in the fields of energy, transportation and regulatory economics.

170,000 car years – a much smaller but still significant reduction in capacity. This loss in capacity would be equivalent to removing the entire crude oil and ethanol fleets from service for a period of several years. If this loss were allowed to occur, between 2018 and 2020, thirty percent (30%) to fifty percent (50%) of the total crude oil and ethanol fleet not expected to be retired could be idled and unavailable to move product. See Exhibit B2 found in Appendix D. The impacts of such a loss of capacity could dwarf the direct compliance cost for the proposed modifications, which comes to approximately $3.0 billion dollars for the entire crude oil and ethanol fleet, even after accounting for a projected twenty-eight percent (28%) early retirement rate for Legacy DOT-111 cars.[56] See Exhibit B3 found in Appendix D.

The effect of removing these cars from service while they await modification will be substantial. Brattle's preliminary analysis of the effect of requiring legacy DOT-111 and noncompliant CPC-1232 cars to be modified or removed from crude oil and ethanol service by October 1, 2017 indicates that there will be significant disruption to major sectors of the North American economy. The resulting reductions in annual tank car loads, as set forth in the Exhibit B4 found in Appendix D, illustrate the impact that the Proposed Regulations will have on rail capacity. In 2017, the year in which the first proposed compliance deadline falls, tank car loads of crude oil and ethanol will be reduced by approximately 170,000. In the following year, the first full year in which the restrictions apply, the effects on North American crude oil and ethanol rail traffic will be substantially larger. Brattle projects that crude oil and ethanol car loads will be reduced by approximately 820,000. Year by year details are shown in Exhibit B4 found in Appendix D.

These effects on rail capacity translate into significant implications for shippers and other affected parties. Service interruptions and supply chain disruption will be commonplace. It is difficult to project how producers, shippers and other affected parties will respond to this situation. Possible responses include diverting commodity transport to other modes, cutting back production, and/or scrapping the existing fleet and rebuilding. There are significant uncertainties regarding what might become of the affected cars, what might become of the affected traffic, and what might become of the affected crude oil and ethanol production.

1. Fate of the Affected Fleets

For purposes of modeling the likely impacts of the Proposed Regulations, Brattle has assumed that any existing tank cars that do not comply with requirements at the time of the compliance deadline will be taken offline and parked until the shop capacity needed to carry out the required modifications becomes available, at which point Brattle assumes they will return to their original service. Brattle recognizes, however, that this is but one of a number of possible outcomes. Some of these cars might be transferred to other services, either permanently or temporarily. It is also possible that they might simply be removed from service and scrapped.

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[56] The RSI-CTC surveyed its members regarding fleet demographics, materials of construction, and design criteria to develop the estimated 28% retirement rate for all legacy DOT-111s.

PHMSA has assumed that major portions of the affected fleets would be permanently transferred to serve heavy crude oil from Western Canada, which PHMSA refers to as "tar sands." Below in Section X.A. Brattle identifies the regulatory, technical and economic barriers to such a transfer and discusses why it thinks it is unlikely to occur. The affected fleets are large, and have been configured for the requirements of the markets they serve. The RSI-CTC does not believe there are many other commodities whose density, shipment volumes, packaging requirements and capacity needs would be suited to the use of significant numbers re-purposed crude oil or ethanol tank cars. These markets are already adequately served by existing tank car fleets, and absent significant growth would not have the ability to absorb the repositioned assets. Even if transfer to another commodity were possible, these cars would still need to be cleaned for reassignment—which would utilize scarce repair network capacity and further constrain the limited resources available to complete the modification program.

While Brattle has assumed that the affected cars will be parked until the resources required for the modification become available, it also recognizes that for some of the fleet, this may not turn out to be an economically viable course of action. There are significant unanswered questions regarding what it would cost to store thousands of idle cars for multi-year periods, or what condition these cars might be in at the end of these periods. In many cases, the modification costs that would have to be incurred to bring them into compliance is a significant fraction of the original cost of the car. It is likely that in many cases, the economically rational solution will be to remove them permanently from service and scrap them. However, this decision will be made by individual owners based on the remaining economic life of the car.

Another possible effect of the Proposed Regulations might be to encourage affected parties to purchase new cars to replace the capacity that would potentially be idled by the Proposed Regulations. While Brattle concedes that this is a possibility, its quantitative significance is very difficult to assess. Tank cars are highly durable assets that can under normal circumstances be expected to remain in service for decades. There is an inherent economic tension involved in a decision to invest in such a durable asset in order to offset the effects of a temporary capacity shortfall. Brattle recognizes that it might happen, but it is difficult to judge the magnitude or potential economic significance of any such investments. Moreover, replacement of the existing fleet cannot take place until after 2015 when all committed tank cars in the order back log have been filled and delivered. See Section IX.C. for additional discussion.

2. Fate of the Affected Traffic

Faced with a sudden and significant loss of rail capacity, shippers will undoubtedly attempt to shift traffic to alternative modes. Their choices, however, are limited. Some crude oil may move toward barge or pipeline transportation. However, because pipeline and barge are cheaper modes of transportation than both rail and trucking, we can assume that if these are not currently utilized, it is because these modes are unavailable for crude oil transportation in the relevant geographic regions.[57] For this reason, it is

[57] A variety of industry observers have noted that pipelines lack the flexibility of rail, and so are less suited to many of the new oil developments. *See e.g.* Kevin Sterline, William Horner, Chip Rowe, BB&T Capital Markets Report "Examining the Crude by Barge Opportunity" (June 10, 2013); Curtis, Trisha, "Lagging Pipelines Creat US Gulf

reasonable to assume that truck transportation is the only available alternative mode for much of this traffic.

Brattle estimates that replacing lost rail capacity in 2017 with truck transportation for crude oil and ethanol shipments in North America would require approximately 20,000 trucks carrying over 370,000 truckloads on North American highways. In 2018, the full year in which the loss of capacity will be felt, replacement transportation would require approximately 70,000 trucks carrying almost 1.6 million loads. Note that these figures already reflect what Brattle believes to be reasonable assumptions regarding potential diversions to pipeline and barge transportation.

Table B5: Crude Oil and Ethanol Truck Traffic Required to Replace Lost Rail Capacity

With Regulation	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Trucks Dedicated to Crude and Ethanol Service, thousands	0	0	0	20	69	65	64	56	45	30	14	1
Truckloads, thousands	0	0	0	371	1,600	1,227	1,090	956	762	506	234	12

The safety and environmental consequences of a substantial increase in truck traffic are significant. From 2002-2009, the over-the-road truckers transporting hazardous materials spilled 58% more total liquid hazardous materials and roughly double the total equivalent hazardous materials (including gasses, liquids and solids) than railroads did per year and per billion ton-miles.[58] These trucks would be traveling on major highways and roads alongside passenger traffic. Additionally, between 2015 and 2025, 6.41 million tons of CO_2 emissions would be associated with this increase in truck traffic.

From an economic standpoint, if such traffic diversions were to occur, they would lead to significant increases in transportation costs for shippers. Brattle estimates that, at normal truck transportation rates, the increased costs would amount to $5.4 billion in 2017, and would rise to $21.0 billion in 2018. In subsequent years, these additional costs would decline slowly as the fleet of legacy DOT-111 tank cars is gradually modified or replaced.

Light Sweet Crude Glut," *Oil & Gas Journal* (Mar. 3, 2014). While barge transportation can be an attractive alternative in some situations, its role is limited by transloading and terminal availability and capacity, the size of the barge tanker fleet, and lack of geographic proximity to production areas. In order to use barge transportation, shippers must get crude oil to barge terminals. Often this has been accomplished through reliance on rail.

58 Association of American Railroads, Just the Facts – Railroads Safely Move Hazardous Materials, Including Crude Oil (July 2013).

It is unreasonable, however, to assume that a sudden and substantial increase in truck demand would not affect rates. The current tank truck fleet is fully occupied today hauling other hazardous commodities that require secure trailers with sufficient strength and safety features to provide safe highway transport. If the demand for these same trailers suddenly rises in order to satisfy substantial additional demand from crude oil producers, a shortage of hazardous materials tankers will arise quickly in this market. Rates for their services can be expected to soar. Such increases can be expected to lead to even greater increases in costs to shippers of crude oil and ethanol, but also to significant disruptions to the markets for other commodities currently carried by these tankers.

The direct effects of a shift toward an inherently much more costly mode, especially when combined with significant rate increases, can be expected to have a significant effect on costs to refiners and ultimately to the prices paid by consumers for gasoline and other petroleum products. The magnitude of these effects could be substantial, and that the increased burden on consumers could have measurably adverse effects on the national economy.

It is also unclear whether a modal shift of this magnitude to truck transportation is either operationally or economically feasible. We can assume that the current fleet is matched to the current demand for the commodities it transports. The Proposed Regulations would create a sudden surge in demand for these vehicles. Any rapid change in their production rate would take time to roll out. More importantly, however, it is unclear how fleet owners would respond to what is essentially a temporary surge in demand. Expanding the truck fleet capacity to meet this temporary surge could potentially lead to a situation in which motor carriers would be left with capital investments in trailers that are not fully depreciated, yet are non-competitive with the new rail cars, once the rail fleet is in compliance with the new requirements. Whether they would, in fact, be willing to make the necessary investments under such circumstances is unclear.

Trucking companies would also be required to recruit, screen and train a corresponding number of additional truck drivers to operate an increasing number of trucks. For the past three decades, however, driver retention and recruitment has historically been a significant challenge for the trucking industry.[59] This problem has become especially acute for drivers who qualify and are licensed for transport of hazardous materials.

The rapidly increasing demand for tank trucks, to replace the unusable tank cars, would also distort the truck and trailer manufacturing sectors.

3. Fate of the Affected Production

Even if it were the case that the trucking industry would be able to provide the requisite amount of service, it is not clear that crude oil and ethanol producers would be willing or able to pay for it. Faced with onerous costs of bringing product to market, shippers may

[59] Southern, R. Neil, James P. Rakowski, and Lynn R. Godwin. 1989. "Motor Carrier Road Driver Recruitment in a Time of Shortages." *Transportation Journal* Vol.28, No.4:pp 42-48. Mele, Jim. 1989. "Carriers Cope With Driver Shortage." *Fleet Owner* Vol.84, No.1:pp 104-11. Machalaba, Daniel. 1993. "Long Haul: Trucking Firms Find It Is a Struggle to Hire and Retain Drivers". *Wall Street Journal*, December 28, 1993, pg. 1.

simply opt to decrease North American production rather than incur the costs and absorb the risks associated with a major modal shift to trucking.

Brattle projects that in 2018 over 300 million barrels of oil and 130 million barrels of ethanol that would otherwise have moved to market by rail could potentially be stranded by the unavailability and/or high cost of alternative transportation. To put these figures in perspective, 300 million barrels of oil amounts to 820,000 barrels per day. In 2018, the Energy Information Administration's ("EIA") most recent forecast projects that total U.S. crude oil production will amount to 9.6 million barrels per day. Thus, the potential loss amounts to roughly one twelfth of national production. Proportionately, the impact on ethanol production could be even greater. By 2018, EIA forecasts project that ethanol production will rise to 323 million barrels. Thus, over one third of U.S. ethanol production could be put at risk.

X. PHMSA's Cost-Benefit Analysis

Thorough cost-benefit analysis is the well-established, systematic method by which the U.S. government justifies the imposition of significant new regulations.[60] By Executive Order, PHMSA is required to "assess all costs and benefits of available regulatory alternatives" including quantifiable measures and qualitative measures that may be difficult to quantify.[61] We support the regulatory principles in Executive Order 13563, signed by President Obama on January 18, 2011, which require that "our regulatory system must protect public health, welfare, safety, and our environment while promoting economic growth, innovation, competitiveness, and job creation."[62] We further support PHMSA's and the Administration's objective of accurately assessing both the costs and benefits of the regulation in order to inform adoption of a final regulation that is tailored to "impose the least burden on society, consistent with obtaining regulatory objectives, taking into account, among other things, and to the extent practicable, the costs of cumulative regulations."[63]

In the Proposed Regulations, PHMSA invited comments to address any cost or benefit figures or factors, alternative approaches, and relevant scientific, technical and economic data to help PHMSA evaluate whether the proposed requirements are appropriate. Below we respond to PHMSA's invitation to help evaluate the regulation and identify areas where we disagree with PHMSA's underlying assumptions. The RSI-CTC is primarily concerned with PHMSA's assumptions about repurposing existing tank cars, its predictions regarding the frequency and severity of future derailments, and specific instances where it has underestimated the cost of compliance and the secondary impacts of the Proposed Regulations. Our primary goal is to assist PHMSA in producing a final rule issued "only upon a reasoned determination that the benefits of the intended standard justify its costs."[64]

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[60] *Regulatory Planning and Review*, Executive Order 12866 (Sept. 30, 1993).

[61] *Id.*

[62] *Improving Regulation and Regulatory Review*, Executive Order 13563 (Jan. 18, 2011).

[63] *Id.*

[64] *Regulatory Planning and Review*, Executive Order 12866 (Sept. 30, 1993).

A. PHMSA Should Not Assume 23,000 Tank Cars Will be Reassigned to Serve Heavy Crude Oil from Western Canada Without Costs or Modifications[65]

PHMSA vastly underestimates the number of tank cars that would be impacted by the Proposed Regulations, because it assumes over 23,000 existing tank cars will be reassigned to serve heavy crude oil from Western Canada.[66] In reality, over 109,000 tank cars would be impacted by this rule, not just the 61,880 non-jacketed CPC1232s and non-jacketed DOT-111 tank cars in crude oil and ethanol service identified by PHMSA.[67] (See Appendix C: Measuring the Size of the Affected Tank Car Fleet.)

In its Draft Regulatory Impact Analysis ("Draft RIA"), PHMSA assumes that a large number of cars currently in crude oil service – 7,787 unjacketed Legacy DOT-111 cars, 5,600 jacketed Legacy DOT-111 cars and 9,850 jacketed CPC-1232 cars – will be transferred to serve heavy crude oil from Western Canada. This assumption removes these cars from the fleet of cars that might otherwise require modification to bring them into compliance with the Proposed Regulations that would take effect on October 1, 2017. For a number of reasons, Brattle believes that this assumption is highly speculative.

First, PHMSA has produced no evidence suggesting that Transport Canada will permit a transfer of large numbers of unmodified legacy DOT-111 cars into Canadian service. Indeed, allowing the use of unmodified legacy DOT-111s directly conflicts with the TC Proposed Regulations for flammable liquids.

Second, many of these cars would require extensive modifications before they would be suitable for such service. Heating coils are required in order to permit the unloading of cars loaded with heavy crude oil from Western Canada.[68] Many of the cars that PHMSA assumes would move into Canadian service currently lack such coils.[69] Third, many of the cars that PHMSA suggests would be reassigned are not designed to handle this product efficiently. Heavy crude oil from Western Canada is much denser than the crude oils that these cars normally carry. In order to keep them under applicable weight limits, it would be necessary to operate them at less than full capacity.

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65 This section is responsive to Q1, Q3 – Existing Tank Cars for HHFTs, 79 Fed. Reg. 45061.

66 Although we use the term "heavy crude oil from Western Canada" this is synonymous with the term "Canadian tar sands" which is used by PHMSA in the NPRM and the Draft RIA.

67 Draft RIA at 84.

68 As an alternative to reliance on heating coils, heavy crude oil from Western Canada could be mixed with diluent, as is currently done in order to permit these crudes to be shipped by pipeline. Doing so, however, would convert this from a Class 3, PG III product into a Class 3, PG I or II product, undermining the whole rationale for moving these cars into this service in order to take them outside of the coverage of the proposed regulations.

69 We understand that all of the unjacketed Legacy DOT-111 cars and a large fraction of the jacketed CPC-1232 cars lack such coils.

Finally, at present, the number of cars that will be required to transport heavy crude oil from Western Canada is highly uncertain. The Environmental Impact Statement for the Keystone pipeline prepared by the U.S. Department of State discusses a wide range of possible scenarios that differ in terms of the projected volume of domestic crude oil production, the projected rate of growth in U.S. energy consumption, and in the location and amount of pipeline capacity that will be built in coming years. The projected demand for rail transportation of heavy crude oil from Western Canada varies widely across these various scenarios. To assume, as PHMSA has, that thousands of cars could immediately be absorbed into this market appears to be unsupported by data or precedent.

B. PHMSA Underestimates the Cost of Its Modification Program

PHMSA's analysis of the modifications for the existing crude oil and ethanol fleets understates the cost, difficulty and time that will be required to complete them. Its analysis reflects a number of assumptions that do not appear to be realistic.

First, PHMSA assumes that the sizes of the crude oil and ethanol fleets that will require modification will be substantially reduced by the transfer of thousands of cars into service of heavy crude oil from Western Canada. As we explained above, we do not believe that this is a realistic assumption. Moreover, even if the transfer were accomplished, the modifications required to make these cars suitable for this service would have to be carried out in parallel with the modifications required to meet PHMSA's requirements for cars in crude oil and ethanol service. Thus, there is little reason to believe that such a transfer would substantially reduce the burdens imposed by PHMSA's modification requirements.

Second, PHMSA apparently assumes that all of the jacketed CPC-1232 cars (other than the 9,850 that it believes would move to Canadian service) will be built with the improved PRVs and BOVs that are called for in the Proposed Regulations.[70] These assumptions are incorrect. According to the AAR, by the end of the first quarter of this year there were already 7,104 of these cars operating in crude oil and ethanol service. According to RSI-CTC members, a total 13,647 of these cars are scheduled for delivery in 2014, and another 9,730 in 2015. Given that designs for these new valves have not yet been finalized, it is highly unlikely that they will be installed on any of the jacketed CPC-1232 cars scheduled for delivery in 2014. It is doubtful that designs will be finalized and production of the new valves will be far enough along to permit their installation on newly built cars until sometime well into 2015.

Thus, when the rule is finalized, and even assuming for argument's sake that PHMSA's predictions regarding transfers to Canadian heavy crude oil service prove to be correct, there will still be a large subset of jacketed CPC-1232 cars requiring valve replacements. While these modifications are small relative to those required by other sub-fleets, the cars must still be cleaned before these modifications can be carried out. Since car cleaning capacity is a major factor limiting the pace at which the entire modification program can be carried out, this imposes additional maintenance and repair network capacity constraints.

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70 Draft RIA at 77.

A straightforward solution to this problem, which the RSI-CTC urges PHMSA to consider, is to require that valve replacement occur when a jacketed CPC-1232 comes into the shop for normal repair or requalification work, rather than compel an additional shopping. This would allow existing shop capacity to be focused on the modification of cars that do not contain the many safety features already present within the jacketed CPC-1232 fleet.

Third, PHMSA's analysis reflects unrealistically optimistic assumptions about the rate at which modifications can be carried out. PHMSA's Draft RIA assumes that over the 2016-2018 period modifications will be carried out on 43,805 unjacketed legacy DOT-111 cars and 22,380 unjacketed CPC-1232 cars.[71] It is worth noting that even PHMSA's own modification program does not assume that the required modifications can be carried out by the October 1, 2017 deadline, since the modification period it suggests for DOT-111s is from 2016-2018. This timeline assumes that modifications can be carried out at a rate of over 1,800 cars per month.[72] Even if one were to assume that these modifications could begin on January 1, 2015 (an assumption that RSI-CTC members do not believe is realistic, give the ramp up period that would be required to order parts and components and hire and train the necessary workforce), achieving PHMSA's timeline would require that modifications be carried out at a rate of nearly 1,400 cars per month. These rates are far in excess of the most optimistic estimates of industry capacity prepared by RSI-CTC members. During the initial years of the program when the most complex modifications are being carried out on the non-jacketed legacy DOT-111 cars, the RSI-CTC does not believe that it will be possible to process more than 550 cars per month. While it may be reasonable to assume some increase in throughput rates as shops become more familiar with the process, we do not believe that under any realistic scenario it will be possible to approach anything close to the rates assumed in PHMSA's analysis.

Finally, PHMSA's analysis also seems to have made a number of overly optimistic assumptions about the costs of carrying out the required modifications. Specifically, PHMSA has assumed that the cost of installing a full height head shield on non-jacketed legacy DOT-111s adds only $400 to the cost of installing a full jacket, whereas in previously filed comments, the RSI-CTC had estimated that installation of these shields would cost $17,500. PHMSA also reduces the costs of its overall modification packages by ten percent due to unspecified economies of scale. The RSI-CTC questions the reasonableness of this assumption, and believes that a major modification program of this nature carried out under enormous time pressures is equally—if not more likely—to experience *increases* in cost due to production bottlenecks, shortages of critical materials and categories of skilled labor, payment of overtime wages and other such factors.

[71] Draft RIA at 91-92.

[72] Draft RIA at 91, Table TC12.

C. PHMSA's Benefit and Cost Calculations Do Not Adequately Not Support Its Recommended Course of Action

We have a full appreciation of the seriousness of the situation PHMSA is attempting to address, the complexity of the issues to be dealt with, and the time constraints under which it is operating; however, we believe that there are a number of significant weaknesses in the benefit and cost calculations as they have been presented by PHMSA. We question whether its findings provide adequate support for its recommended course of action.

We focus here on what we believe are some of the most serious weaknesses in the calculations PHMSA has presented. The RSI-CTC intends to file a separate report prepared by Brattle further analyzing the economic impacts of the Proposed Regulations.

1. PHMSA's analysis significantly overstates the likelihood of extra-ordinary events like Lac Mégantic

PHMSA's Draft RIA relies to an extraordinary extent on a single tragic event—the derailment at Lac Mégantic—to estimate the cost of a derailment. There is no reason to believe that this event is representative of other potential events. Indeed, by a number of objective measures, this tragic event is an extreme outlier. This one extraordinary event plays a major role in PHMSA's analysis. PHMSA recognizes this fact, admitting that "benefits fail to exceed costs for all options if no high-consequence events are assumed to occur."[73] Thus, PHMSA's benefit conclusions depend critically on the value the analysis assigns to the probability of another such event occurring.

PHMSA's upper bound benefits calculation assumes a 1 in 20 chance of another Lac Mégantic-like event (adjusted for population density) occurring in the next twenty years. The Draft RIA provides no statistical basis for this probability. Objective measures of the probability suggest a much lower likelihood that a similar event will occur over this period.

As shown in the figures below, several of the event characteristics—speed, number of tank cars having a release, and gallons spilled—were more than two standard deviations above the averages of historic events.[74] The Lac Mégantic train was traveling at 65 mph. This is 2.89 standard deviations above the mean of 23.6 mph. A total of 59 cars released product in the Lac Mégantic incident.[75] This is 8.04 standard deviations above the mean of 4.38. Finally, 1,582,032 gallons of oil spilled in the Lac Mégantic incident. This is 9.02 standard deviations above the mean of 71,915 gallons. Thus, by all three of these significant measures, Lac Mégantic was an extreme outlier event.

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[73] Draft RIA at 190.

[74] Draft RIA, Appendix B.

[75] TSB Lac Mégantic Report at 39.

Figure 3: Incidents by Speed (mph)

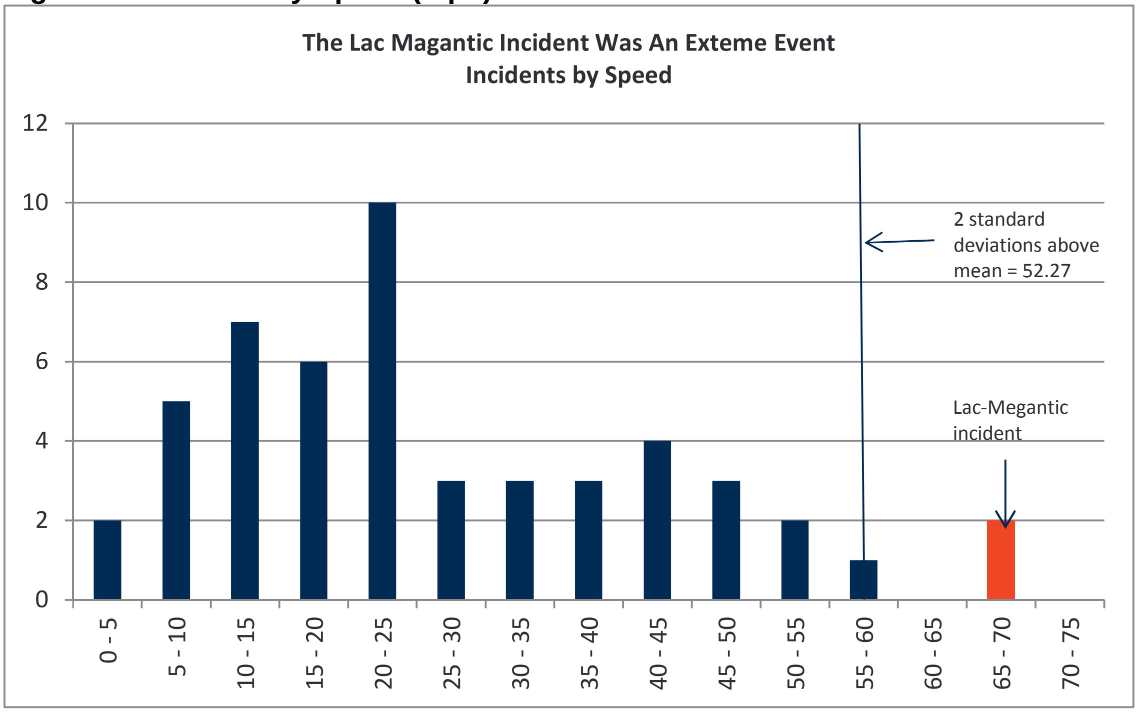


Figure 4: Incidents by Number of Cars Releasing Hazardous Material

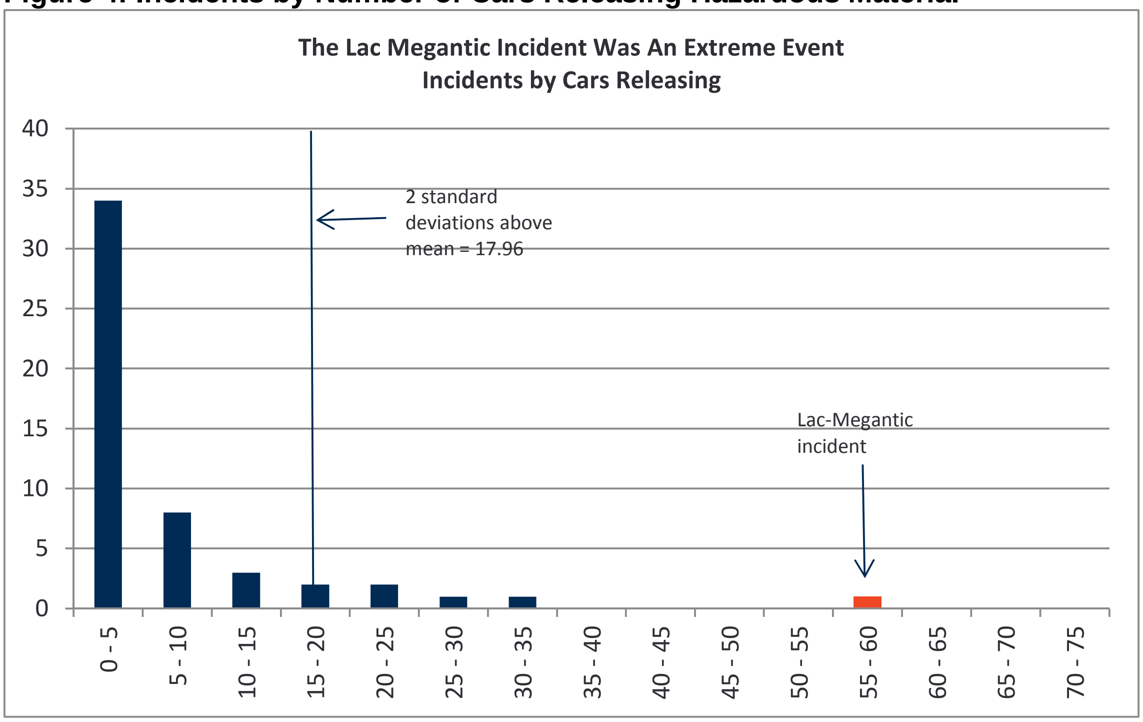
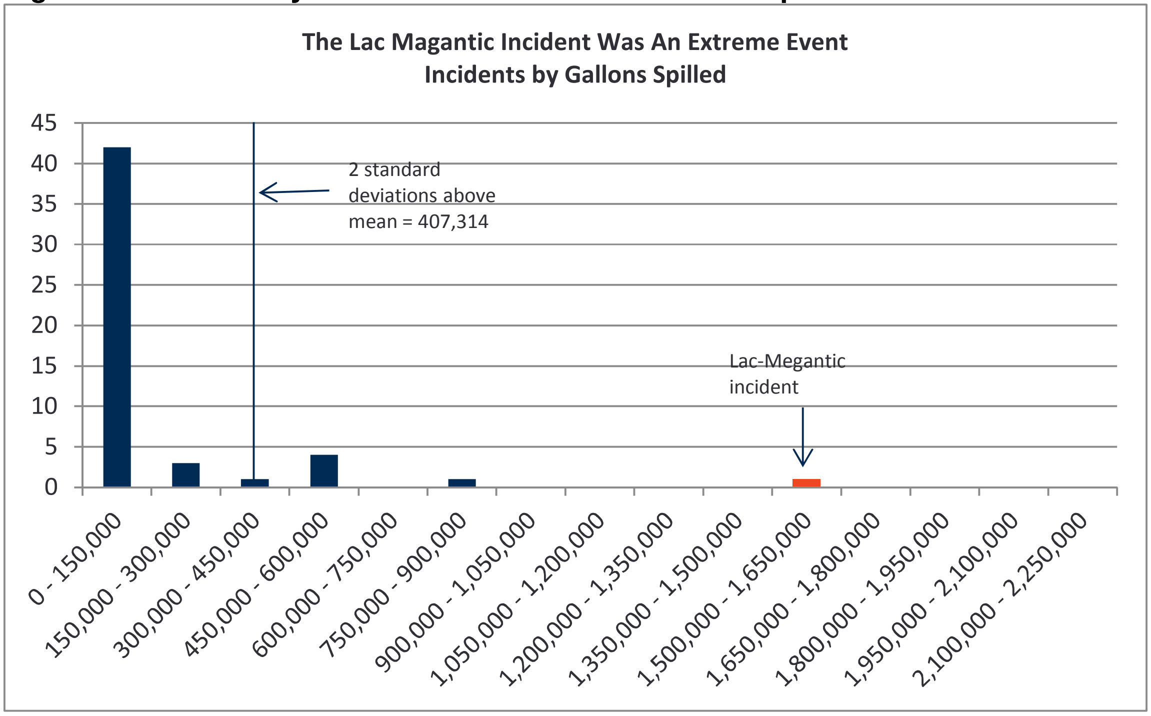


Figure 5: Incidents by Gallons of Hazardous Materials Spilled



2. The Effectiveness of the Proposed Regulation Does Not Account for Unintended Consequences of Modal Shift

Effectiveness is not adjusted for the increased accidents that can be expected to result from increased reliance on trucks. More trucks on the road carrying crude oil and ethanol will result in increased truck accidents that will offset a portion of any gains from reduced rail accidents. Brattle's model projects that there will be a substantial increase in truck accident related spills associated with the increased reliance on truck shipments for the period 2017-2025, if the proposed regulatory schedule is implemented. Based on PMSHA data on accidents per ton mile and costs per accident, the modal shift will result in $145 million in additional costs not reflected in the Draft RIA calculations.

Exhibit B6: Changes in Truck Incidents by Year

Year	Increase in millions of ton-miles shipped	Incidents per million ton-miles	Increase in incidents	Costs per incident	Increase in Costs
	[1]	[2]	[3] = [1] x [2]	[4]	[5] = [3] x [4]
2014	0	0.0169	0	$39,730	$0
2015	0	0.0169	0	$39,730	$0
2016	0	0.0169	0	$39,730	$0
2017	19,397	0.0169	328	$39,730	$13,015,185
2018	66,037	0.0169	1,115	$39,730	$44,310,724
2019	61,579	0.0169	1,040	$39,730	$41,319,815
2020	60,847	0.0169	1,028	$39,730	$40,828,274
2021	53,871	0.0169	910	$39,730	$36,147,674
2022	43,150	0.0169	729	$39,730	$28,953,447
2023	28,633	0.0169	484	$39,730	$19,212,906
2024	13,171	0.0169	222	$39,730	$8,838,058
2025	670	0.0169	11	$39,730	$449,487
2026	0	0.0169	0	$39,730	$0
2027	0	0.0169	0	$39,730	$0
2028	0	0.0169	0	$39,730	$0
2029	0	0.0169	0	$39,730	$0
2030	0	0.0169	0	$39,730	$0
2031	0	0.0169	0	$39,730	$0
2032	0	0.0169	0	$39,730	$0
2033	0	0.0169	0	$39,730	$0
2034	0	0.0169	0	$39,730	$0
Total					**$233,075,570**
NPV					**$145,433,465**

Sources and Notes:

[1] Output from mode-shifting model

[2] PHMSA data for trucking incidents

[4] Calculated average costs per incident from PHMSA data for trucking incidents

NPV is calculated using a 7% discount rate

D. PHMSA's Cost Benefit Analysis Fails to Make a Compelling Case for Any of the Policy Options Under Consideration

PHMSA's cost-benefit analysis does not support any of the options under consideration. Ideally, benefits should exceed costs to indicate that a policy meets OMB Circular A-4 standards.[76] Even if one were to assume that PHMSA's benefit and costs are calculated correctly, then by PHMSA's own estimates, costs exceed benefits for most of the elements of its proposal, and often by a very significant margin. These calculations are summarized below. As noted elsewhere in these comments, there are reasons to question the accuracy of both the benefits (too high) and the costs (too low) presented in the Draft RIA.

Exhibit B7: Costs and Benefits of Regulatory Proposals as Calculated by DOT

Regulatory Proposal	Cost (millions)	Benefits		Net Benefits	
		Low	High	Low	High
Rail Routing	4.5	na	na		
Classification of Mined Gas and Liquid	16.2	na	na		
Notification to SERCs	0	na	na		
Speed Restriction: 40mph all areas	2,680	199	636	-2,481	-2,044
Speed Restriction: 40mph areas 100k population	240	33.6	108	-206.4	-132.0
Speed Restriction: 40mpg in HFUAs	22.9	6.8	21.8	-16.1	-1.1
Braking	500	737	1759	**237**	**1,259**
PHMSA and FRA designed car (option1)	3,030	822	3,256	-2,208	**226**
AAR 2014 car (option 2)	2,571	610	2,426	-1,961	-145
Jackteted CPC-1232 (new construction) (option 3)	2,040	393	1,570	-1,647	-470
PHMSA and FRA (option 1) stripped of braking	2,530	85	1,497	-2,445	-1,033

**Bold indicates benefits approximately equal or exceed costs*

While we fully support PHMSA's efforts to improve safety, we believe that the agency's own calculations make a powerful case for the importance of finding ways to reduce the costs of achieving these improvements.

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[76] OMB Circular A-4 (September 17, 2003), *available at* http://www.whitehouse.gov/omb/circulars_a004_a-4. page 2 ("The motivation is to (1) learn if the benefits of an action are likely to justify the costs or (2) discover which of various possible alternatives would be the most cost-effective."

E. Critical Economic Impact Analysis is Missing

1. No consideration of Modal Shift

As explained above in Section IX.C.2, the Proposed Regulations will likely result in modal shift resulting in an increase in transportation by truck. Should the Proposed Regulations cause a substantial shift to transport by truck, the resulting costs could be as high as $21 billion in 2018, as we previously noted. However, neither the Proposed Regulations nor the Draft RIA account for the implications that mode choice will have on shipping costs and ultimately consumer prices.

2. Potential Impacts of Crude Oil Production Losses

The majority of legacy non-insulated, non-coiled DOT-111 tank cars transporting crude oil carry a light, sweet (low sulphur), low viscosity grade of crude oil. Since 2008, exploration and development of oil resources in various nontraditional locations has led to a dramatic increase in production of this type of crude oil. The most important of the major new producing areas is the Bakken region of North Dakota and Montana. However, there has also been new production in the Eagle Ford region of Texas and from Niobrara Formation in Colorado and New Mexico. These resources are located far afield and are not connected to the nation's existing pipeline network. Transport by rail has played a critical role in their development.

Concurrent to the development of these new resources, Eastern refiners were subject to economic distress caused by offshore oil supply disruptions and rising raw material costs. It is not unreasonable to say that if it were not for the availability of the lighter grades of crude oil being produced in North Dakota or South Texas, that the North American economy would have experienced significant reductions in refining capacity. These reductions would have increased the prices of transportation fuels throughout the economy.[77]

It should also not be forgotten that a significant portion of the Bakken production flows to the west coast supplying refineries in California and Washington. These supplies of raw materials are required primarily as replacement for declining production from the Alaskan Northern Slope production areas. The only viable supply alternative for these refineries would be to source water-born raw materials from foreign sources.

The economic impacts of crude oil production losses of the magnitude we have projected are possible and would result in substantial national effect. And, the direct effects on the regions in which this production is located could be devastating. The growing availability of affordable, light, domestically produced crude oil has had a beneficial effect on many industrial sectors, including refining, chemicals, and many others, providing an important boost to the economy during an otherwise difficult period. Many of the resulting economic gains could be, at best, postponed, or, at worst, reversed, if the proposed regulations results in a sudden loss of vitally needed transportation capacity.

[77] U.S. Energy Information Administration, "Potential Impacts of Reduction in Refinery Activity on Northeast Petroleum Product Markets" (February 2012, updated May 11, 2012).

3. Potential Impacts of Ethanol Production Losses

Ethanol has come to play a crucial role in gasoline production. Required reductions in carbon monoxide (CO) and nitrous oxide (NOX) emissions established by the Clean Air Act of 1990 compelled refiners to produce gasoline with higher oxygen content and to vary gasoline formulations seasonally. The oil refining industry initially responded by blending the gasoline fuel stock with a material known as MTBE. While MTBE performed well as a gasoline blending agent, ground water contamination concerns in California forced refiners and gasoline marketers to seek alternatives. Ethanol has become that alternative. Its importance was further stimulated by enactment of Renewable Fuel Standard (RFS) as created under the Energy Policy Act of 2005. The RFS mandate was later expanded under the Energy Independence and Security Act of 2007, which called for a ramp-up of gross production of renewable fuels, resulting in today's mandate of roughly 14 billion gallons of ethanol being produced annually.

For a variety of reasons, rail transportation has played an important role in facilitating the expansion of ethanol production. The economics of ethanol production require that plants locate in rural areas close to raw materials, namely corn. Ethanol does not travel well by pipeline given its tendency to absorb water which leads to corrosive mixtures. Historically, the distances from production locations to centers of consumption were such that truck transportation was, in most cases, uneconomic.

A number of significant consequences could flow from a major reduction in ethanol production. Given that failure to properly blend oxygenate per seasonal requirements is a criminal offense prosecuted by the U.S. Environmental Protection Agency, suppliers can be expected to err on the side of caution. Restricted ethanol supplies could cause gasoline blenders/marketers to approach EPA for waivers to the RFS as well as reformulated gasoline standards. Any such waivers would result in higher emissions of CO and NOX and place emission systems on today's vehicle fleet at risk. This would result in higher emissions and place emission systems on today's vehicle fleet at risk. Alternatively, ethanol could be imported but the only significant source of supply is Brazil. The U.S. supply of primary transportation fuel then would be dependent upon Brazil's output of sugar cane as well as the world's output of hydrocarbons.

We respectfully urge PMHSA to consider potential economic consequences in weighing the costs and benefits of the proposed regulations.

XI. Nationally Uniform Prescriptive Standards Are Essential to Safe and Efficient Rail Transportation

Compliance with a single set of nationally uniform federal standards is critical to ensuring a safe and efficient rail transportation system. The alternative is a patchwork of inconsistent state laws and regulations requiring different equipment and different operating practices in every state. The DOT's relevant authorizing legislation has recognized the importance of national uniformity, and the current rule making should be careful to recognize those Congressional priorities. Specifically, both the Federal Railroad Safety Act ("FRSA") and the Hazardous Materials Transportation Act ("HMTA") contain express preemption provisions to protect the national uniformity of federal safety standards. PHMSA's new regulations should be crafted to be consistent with these statutes, and should be designed to promote federal uniform safety standards as reflected in this authorizing legislation.

A. Compliance Under the FRSA and HMTA

Congress enacted the FRSA in 1970 "to promote safety in every area of railroad operations and reduce railroad-related accidents and incidents."[78] The FRSA gives the Secretary of Transportation broad powers to prescribe appropriate rules, regulations, orders, and standards for all areas of railroad safety.[79] In order to ensure national uniformity of federal safety standards, including those relating to tank cars, the FRSA includes an express preemption clause:

> Laws, regulations, and orders related to railroad safety and laws, regulations, and orders related to railroad security shall be nationally uniform to the extent practicable. A State may adopt or continue in force a law, regulation, or order related to railroad safety or security until the Secretary of Transportation (with respect to railroad safety matters), or the Secretary of Homeland Security (with respect to railroad security matters), prescribes a regulation or issues an order covering the subject matter of the State requirement.[80]

In 2007, Congress amended the FRSA preemption clause to add a "[c]larification regarding State law causes of action."[81] The new language permits certain state actions to proceed where a plaintiff alleges failure to comply with a Federal standard of care established by a federal regulation or order, or failure to comply with a defendant's own plan, rule, or standard created pursuant to a federal regulation or order.[82]

Congress enacted the HMTA, 49 U.S.C. § 5101 – 5128, in 1975 to develop "a uniform, national scheme of regulation regarding the transportation of hazardous materials."[83] Congress subsequently expanded on this objective fifteen years later when it amended the HMTA and found, among other things, that "many States and localities have enacted laws and regulations which vary from Federal laws and regulations pertaining to the transportation of hazardous materials, thereby creating the potential for unreasonable hazards in other jurisdictions and confounding shippers and carriers which attempt to comply with multiple and conflicting registration, permitting, routing, notification, and other regulatory requirements."[84]

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[78] 49 U.S.C. § 20101; *Norfolk So. Ry. Co. v. Shanklin*, 529 U.S. 344, 347 (2000).

[79] 49 U.S.C. § 20103(a); *CSX Transp., Inc. v. Easterwood*, 507 U.S. 658, 662 (1993).

[80] 49 U.S.C. § 20106(a)

[81] 49 U.S.C. § 20106(b).

[82] *Id.*

[83] *Roth v. Norfalco LLC* , 651 F.3d 367, 370 (3rd Cir. 2011)(citing *CSX Transp., Inc. v. Williams*, 406 F.3d 667, 674 (D.C. Cir. 2005).

[84] *Id.* at 371 (citing the Hazardous Materials Transportation Uniform Safety Act of 1990, Pub L. No. 101–615, § 2, 104 Stat. 3244, 3245 (1990)).

The HMTA empowers the Secretary of Transportation to "prescribe regulations for the safe transportation, including security, of hazardous materials in intrastate, interstate, and foreign commerce."[85] The Hazardous Materials Regulations, 49 C.F.R. §§ 171-180.605, which are promulgated under this authority, include the tank car specification requirements found in Part 179. Like the FRSA, the HMTA has an express provision that preempts state and local laws that are not substantively the same as the laws and regulations pertaining to the packaging of hazardous materials and the design, manufacture, fabrication, inspection, maintenance, and repair of hazardous materials packaging.[86]

Because the FRSA preemption clause refers to acts "by the Secretary," a regulation affecting railroad safety promulgated pursuant to the HMTA also enjoys the FRSA's preemptive effect.[87] Accordingly, regulations addressing tank car specifications for new builds and existing tank cars will fall within the purview of HMTA and FRSA preemption.

B. The Final Regulations Should Reiterate the Importance of Federal Preemption

In order to protect the uniformity of national safety standards, it is essential that PHMSA provide prescriptive standards that clearly advise a tank car owner whether its new tank cars or modified tank cars are in compliance with the federal regulations. There are two things that PHMSA can do to ensure the Proposed Regulations protect the national uniformity of safety standards. First, PHMSA should promulgate clear, specific, prescriptive standards for new builds and for the modification of existing tank cars. Second, PHMSA should add additional language to the Proposed Regulations to make certain there is no doubt about what PHMSA requires, and reconfirm that the new federal requirements preempt all other requirements related to flammable liquids tank cars.

Prescriptive standards are the most effective way for PHMSA to ensure that manufacturers and tank car owners are able to determine whether new and existing tank cars are in compliance with federal regulations. Although the RSI-CTC recognizes that performance standards may afford some manufacturers and builders an alternative route for design approval, the RSI-CTC respectfully recommends that PHMSA adopt express prescriptive design requirements for each modification that would be required for existing tank cars. For example, the Proposed Regulations include 18 MPH and 12 MPH performance standards for head and shell puncture resistance as an alternative means to achieving compliance with the new car requirements. However, merely providing such performance standards, particularly for modified cars, makes it difficult for owners and

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85 49 U.S.C. § 5103(b)(1).

86 49 U.S.C.A. § 5125; *see also* 49 C.F.R. § 179.8.

87 *CSX Transp., Inc. v. Pub. Util. Com'n of Ohio,* 901 F.2d 497, 501 (6th Cir.1990)(finding that Congress intended for the preemption provisions of FRSA to apply to hazardous material regulations adopted under HMTA applicable to the railroads). *Missouri Pacific Railroad Co. v. Railroad Com'n of Texas,* 671 F.Supp. 466, 471 (W.D.Tex.1987), aff'd 850 F.2d 264 (5th Cir.1988).

builders to be certain that they are in compliance. Accordingly, there is no substitute for express specifications and design requirements.

If performance standards remain a component of the final rule for either new cars or modified tank cars, it is critical that PHMSA also provide detailed regulations explaining the type of testing/modeling required, which commodities must be tested, and an express procedure for submitting tank car designs and models for approval and certification of compliance with the regulation. Unless the performance standards provide this level of detail, manufacturers and tank car owners will be reluctant to utilize the performance standards given the compliance uncertainty.

To the extent performance standards are included in the final regulations as a means to encourage innovation in the design of tank cars and appurtenances, use of new materials, PHMSA should consider adding language detailing the effect of FRA approval of tank cars designed to satisfy performance standards. We recommend including language similar to the following in the performance standard provisions, for proposed sections 179.202-11, 179.203-11,179.204-11:

> *Effect of FRA Approval*. If the Associate Administrator for Railroad Safety/Chief Safety Officer, FRA approves by order a new tank car design and a tank car is constructed in accordance with the conditions of the approval, this determination is conclusive evidence of compliance with the regulation and preempts any State law, statute, regulation, common law, or order concerning the adequacy of the tank car design consistent with 49 U.S.C. § 20106.[88]

We also recommend that PHMSA use explicit language regarding the duty to modify, to leave no doubt that the federal tank car specification regulations cover the subject matter, consistent with the FRSA preemption standard. If PHMSA merely explains that once modified existing cars may continue in use, it may not be sufficient to dispel uncertainty as to whether modifications imposed by state law are preempted. To address these concerns, we recommend that PHMSA consider including a provision expressly outlining the scope of the duty to modify, which clearly states that tank car manufacturers, owners, lessors, lessees and operators have no duty to modify, repair, or retrofit existing tank cars to conform to the new requirements except as specified in the final regulations.

Finally, we respectfully urge PHMSA to add language that clarifies that tank cars need not be modified until the compliance date set forth in the regulations. Such language would eliminate confusion as to whether the modifications must be performed immediately or whether they may be performed at any point prior to the compliance deadlines contemplated by the regulations. During such a transition period, PHMSA should make clear that the regulations in effect prior to the effective date of the new regulations will continue to preempt claims under any non-federal law, statute, regulation, common law, order, or other requirement that purports to impose additional requirements upon a tank car covered under this section. Addressing this issue directly

[88] Similar language has been used to describe the preemptive effect of Secretarial approval in the context of fostering innovation of new technology to improve safety at highway-rail grade crossings. *See* 49 U.S.C. § 20161(d).

would make it clear that the new regulations do not limit or eliminate preemption under the HMTA, 49 U.S.C. § 5125, or the FRSA, 49 U.S.C. § 20106.

It is critical that the final regulations continue to protect the uniformity of our national safety standards to prevent a patchwork of state regulations and inconsistent state imposed duties from arising. A varying set of state regulations would undermine the safety, effectiveness, and efficiency of the national rail transportation system and the federal regulations implemented to protect this system.

XII. Conclusion

The RSI-CTC appreciates the opportunity to submit comments to PHMSA and requests that you give them serious consideration as you prepare for publication of the Final Rule. The RSI-CTC also intends file a separate report prepared by The Brattle Group further analyzing the economic impacts of the Proposed Regulations. This report will be completed and submitted to the HM-251 docket soon after the September 30, 2014 deadline. We look forward to working cooperatively with U.S. Department of Transportation and Transport Canada to ensure the safe transportation of flammable liquids through an effective, timely, and harmonized final rule that will maintain the viability of the North American rail transportation system. Please contact me should you have any questions about our comments or recommendations.

Sincerely,

Thomas D. Simpson
President

Appendix A: Comparison of U.S. and Canadian Proposed Regulations

	TRANSPORT CANADA	US DOT		
Operation	Operating in Canada	High Hazard Flammable Trains (HHFT) - Speed Restriction		
New Tank Car Specifications	**TC 140**	**DOT 117(1)**	**DOT 117(2)**	**DOT 117(3)**
	9/16" tank thickness	9/16" tank thickness (TC128B)	9/16" tank thickness (TC128B)	7/16" tank thickness (TC128B)
	TC128 Grade B, normalized	TC128 Grade B, normalized	TC128 Grade B, normalized	TC128 Grade B, normalized
	TIH Rollover protection	TIH Rollover protection	Top fittings protection	Top fittings protection
	Reconfigured BOV	Reconfigured BOV	Reconfigured BOV	Reconfigured BOV
	ECP brakes	ECP brakes	Distributed Power/2 way EOT	Distributed Power/2 way EOT
	Reclosing PRV	Reclosing PRV	Reclosing PRV	Reclosing PRV
	11 ga. Jacket; A1011 steel	11 ga. Jacket; A1011 steel	11 ga. Jacket; A1011 steel	11 ga. Jacket; A1011 steel
	Thermal protection system	Thermal protection system	Thermal protection system	Thermal protection system
	286k GRL	286k GRL	286k GRL	286k GRL
	Full height headshield (1/2")	Full height headshield (1/2")	Full height headshield (1/2")	Full height headshield (1/2")
New Tank Car Performance Standard	Head: 17 MPH on center, 12x12 with 286k	Head: 18 MPH on center, 12x12 with 286k	Head: 18 MPH on center, 12x12 with 286k	Head: 17 MPH on center, 12x12 with 286k
	Shell: 12 MPH on center, 12x12 with 286k	Shell: 12 MPH on center, 12x12 with 286k	Shell: 12 MPH on center, 12x12 with 286k	Shell: 9 MPH on center, 12x12 with 286k
Existing Tank Car Modification Requirements	**Legacy DOT-111s**	**Legacy DOT-111/CPC-1232**		
	Top Fittings Protection	n/a		
	Reconfigured BOV	Reconfigured BOV		
	Reclosing PRV	Reclosing PRV		
	7/16 inch shell thickness*	Tank shell/head puncture criteria (per adopted Tank Car Spec.)		
	11 ga. Jacket*	11 ga. Jacket or meet 117P performance standard		
	Insulation/Thermal Blanket	Thermal protection system (CFR § 179.18)		
	Full height headshield (1/2")*	Full height headshield (1/2"); Must meeting 117P performance standard. Note: 18 MPH (Option 1 and 2) and 17 MPH		
	TC128 Grade B, normalized	TC128 Grade B		
	n/a	Distributed Power/2 way EOT		
	CPC-1232			
	Reconfigured BOV	* If minimums are not met, then performance standard applies		
	Reclosing PRV			
	11 ga. Jacket			
	Insulation/Thermal protection			
	Full headshields			
Time Line				
Crude Oil/Ethanol	May 1, 2017			
Class 3, PGI	May 1, 2020	October 1, 2017		
Class 3, PGII	May 1, 2022	October 1, 2018		
Class 3, PGIII	May 1, 2025	October 1, 2020		

Appendix B: Schedule of Costs and Out-of-Service Time

Modification/Component	Cost to Existing Cars (Per Car Basis)	Out-of-Service Time (Per car basis)
Pressure Relief Valve • If added at requalification • If additional shopping is required	 • $2,100 • $3,400	 • No add'l time • 5 weeks
Jacket	$16,000	[1]
Full Height Head Shield	$23,000	[1]
Reconfigured Bottom Outlet Valve Handle • If added at requalification • If additional shopping is required	 • $600 • $2,500	 • No add'l time • 5 weeks
Top Fittings Protection	$24,500	7 weeks
Thermal Blanket Application	$3,700	1 week
Truck Upgrade (with M-976 compliant castings) • With waiver (cost of adaptor pads, friction wedges, springs) • Without waiver (new wheel sets required)	 • $2,850 • $16,050	 • [1] • [1]
Truck Upgrade (w/o M-976 compliant castings) • With Waiver (cost of castings, adaptor pads, friction wedges, springs) • Without Waiver (new wheel sets required)	 • $11,400 • $24,600	 • [1] • [1]
ECP Brake Overlay • As a new car feature • As applied to modified tank cars	 • $7,300 • $7,800	 • [1] • [1]
Railroad Delivery of Tank Car to Repair Facility	n/a	2 weeks
Railroad Delivery of Tank Car from Repair Facility	n/a	2 weeks
Option 3 – Full Modification of a Non-Jacketed Legacy DOT-111 (top fittings protection not included) [1] = To be completed as part of the full Option 3 package	$48,250 - $70,000 (depending on truck upgrade)	16 weeks including railroad delivery times

Appendix C: Measuring the Size of the Affected Tank Car Fleet

PHMSA's Draft RIA significantly understates the number of cars that might require modification under the Proposed Regulations. While the RSI-CTC appreciates the difficulty of developing accurate measurements of the size of a rapidly changing fleet, we also believe that it is critically important that, in crafting regulations, PHMSA understand just how many cars will be affected by those regulations.

In the introduction to its Proposed Regulations, PHMSA notes the rapid growth that has taken place in shipments of crude oil by rail. Between 2009 and 2013, the number of car loads of crude oil moving by rail grew from 10,800 to over 400,000.[89] Obviously, this growth in traffic could not have taken place without a comparable expansion of the crude oil tank car fleet. To accommodate actual and planned growth, crude oil producers have ordered, taken delivery of, and placed into service large numbers of new crude oil cars. These realities mean that the size of the crude oil fleet is a moving target. Snapshot views of its size can quickly become out of date.

The rapid growth of this fleet is illustrated by Table C-1, which contrasts AAR measurements of the sizes of the crude oil tank car fleets as of the end of 2013 and the end of April of 2014.[90] To qualify for inclusion in the end of calendar year 2013 totals, a tank car had to have shipped at least one car load of the commodity in question over the period from January 1, 2012 through December 31, 2013. To qualify for inclusion in April 30, 2014 totals, a tank car had to have shipped at least one car load of the commodity in question over the period from January 1, 2013 through April 30, 2014. Over even this brief period, the crude oil fleet expanded substantially.

Table C-1
Number of Cars in Crude Oil Service as of 12/31/13 and 04/30/14

Sub-fleet	Fleet as of 12/31/13	Fleet as of 4/30/14
Non-jacketed Legacy DOT-111s	22,957	23,090
Jacketed Legacy DOT-111s	6,407	7,016
Non-jacketed CPC-1232	9,402	11,364
Jacketed CPC-1232s Cars	4,966	7,712

The task of tracking changes in the crude oil and ethanol fleets is further complicated by the fact that cars are sometimes transferred from one service to another. Because a car must be thoroughly cleaned before it is ready to carry a new commodity, such changes do not occur often. But they do occur. This fact is illustrated by Table BP-1. Over this period, the number of jacketed DOT-111 cars in crude oil service grew from 6,407 to 7,016. Over this period, the only new cars being built for crude oil service were CPC-

89 NPRM, page 9.

90 PHMSA appears to have based its estimates of the size of the crude oil and ethanol fleets on the end of 2013 car counts. *See* Draft RIA at 78.

1232 cars. The increase in the size of the jacketed DOT-111 crude oil fleet could thus have come about only through the transfer of existing cars from other services.

The new car order backlogs provide another indication of the rate at which the tank car fleets covered by the Proposed Regulations are expanding. Table C-2 shows the number of new cars scheduled for delivery in 2014 and 2015. In calendar year 2014, the CPC-1232 tank car fleet is expected to expand at a rate of nearly 1,800 cars per month. Substantial deliveries of both the jacketed and non-jacketed versions of this car are anticipated. These deliveries will continue at a reduced, but still substantial, pace through 2015.

Table C-2
Delivery Schedule for Current New Car Orders

Sub-Fleet	2014 Deliveries	2015 Deliveries
Non-jacketed CPC-1232s	7,481	1,180
Jacketed CPC-1232s	13,647	9,730

The figures presented in Tables C-1 and C-2 do not tell the complete story. A long supply chain connects the facilities where tank cars are manufactured with the unit trains in which crude oil and ethanol move. There are time lags between when crude oil producers place an order and when a car is manufactured, between when a car is manufactured and when it is delivered, between when the tank car is delivered and when the car is placed into service, and between when it is placed in service and when it completes a shipment, and so gets included in AAR car counts. Given the rapid rate at which the crude oil fleet has been expanding, at any given point in time there can be significant numbers of cars at each point in this supply chain.

The best estimate by the RSI-CTC members of what the flammable liquids tank car fleet will look like in 2015 is shown in Table C-3. This estimate is based upon the most recent tank cars counts prepared by AAR, but have been updated to account for projected deliveries of back ordered cars and for cars "in transit" as described above but not yet included in the AAR counts because they have not completed their first shipment.[91]

[91] As noted above, to qualify for inclusion in April 30, 2014 totals, a tank car had to have shipped at least one car load of the commodity in question over the period from January 1, 2013 through April 30, 2014. Because it is possible for an individual car to have carried more than one commodity over this period, it is also possible for a car to appear in more than one fleet. Therefore these numbers are not additive.

Table C-3
Projected Flammable Liquids Tank Car Fleet as of the End of 2015

Sub-fleet	Crude Oil	Ethanol*	Other Flammable Liquids*
Non-jacketed Legacy DOT-111s	23,090	27,037	24,790
Jacketed Legacy DOT-111s	7,016	88	9,413
Non-jacketed CPC-1232s	21,993	751	2,944
Jacketed CPC-1232s	35,408	23	1,975
Total	**87,507**	**27,899**	**39,122**

* Note: Ethanol and Other Flammable Liquids car counts are based on AAR counts of cars that shipped at least one carload of the commodity in question over the period from January 1, 2013 through April 30, 2014. If an individual car switched services during this period, that car will be counted as part of more than one fleet.

PMSHA's fleet size estimates are derived from a presentation given by RSI to NTSB early in 2014.[92] That presentation included some figures showing the sizes of the various crude oil and ethanol sub-fleets, and counts of number of cars on order. The fleet size figures in this presentation were based on AAR end of year 2013 car counts.[93] In using these figures to derive 2014 and 2015 fleet size estimates PHMSA makes a number of assumptions that are not correct. Specifically, PHMSA assumes that all non-jacketed CPC-1232 cars on order will be delivered in 2014, and that an additional 5,000 jacketed CPC-1232 will be delivered this year.[94] Based upon the delivery schedules set forth above in Table C-2, neither of these assumptions is correct.

Further, PHMSA incorrectly assumes that beginning in 2015, only enhanced jacketed CPC-1232s will be delivered into service.[95] While industry has committed to building only enhanced jacketed CPC-1232 cars for crude oil service going forward, these cars may still need minor valve modifications (i.e. addition of the reconfigured BOV and appropriately sized PRV) if they are built before a final rule is in place. Additionally, as table C-2 illustrates, there are 1,180 non-jacketed CPC-1232s on order in the backlog for delivery in 2015. These contracts would need to be renegotiated between the manufacturers and their customers before the order could be changed to a jacketed car.

Table C-4 compares PHMSA's projection of the size and composition of the crude oil and ethanol fleets as of the end of 2015 with that of RSI as set forth above in Table C-3.

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92 RSI-CTC presentation to NTSB rail safety forum April 22, 2014.

93 The figures that appear in this presentation appear, when rounded to the nearest 100, to match counts that appear in end of year 2013 AAR tabulations.

94 Draft RIA at 77.

95 Draft RIA at 32. This paragraph is responsive to Q1 – New Tank Cars for HHFTs, 79 Fed. Reg. 45057. Although we are seeing a rise in the demand for jacketed CPC-1232s, in the absence of new regulations the non-jacketed CPC-1232 would still be permissible for the transport of Class 3, flammable liquids.

These projections differ somewhat, especially at the sub-fleet level. The most significant difference involves jacketed CPC-1232 cars, where PHMSA appears to understate the size of the fleet by almost 6,000 cars.

Table C-4
Comparison of PHMSA and RSI Estimates of End of 2015 Crude Oil and Ethanol Fleets

Sub-Fleet	PHMSA Projection	RSI Projection	Difference
Non-jacketed Legacy DOT-111s	51,592	50,172	1,420
Jacketed Legacy DOT-111s	5,600	7,104	(1,504)
Non-jacketed CPC-1232s	22,380	22,744	(364)
Jacketed CPC-1232s	30,150	35,431	(5,281)
Total	**109,722**	**115,451**	**(5,729)**

Sources: Draft RIA, Table TC5 and C-3.

PHMSA's fleet size estimates and assumptions significantly understate the challenges of modifying the existing fleet of jacketed CPC-1232 cars to bring it into compliance with the proposed regulations. PHMSA starts with a 2013 end-of-year estimate of 4,850 cars, and then assumes that 5,000 additional cars will be added to this fleet in 2014, resulting in a 2014 end-of-year fleet of 9,850 cars. In contrast, if one combines the 4,966 cars shown in Table C-1 above for the 2013 end-of-year jacketed CPC-1232 fleet with the expected 2014 deliveries of 13,647 cars, shown above in Table C-2, one arrives at a 2014 end-of-year fleet of 18,613 cars.[96]

[96] The figure of 4,850 cars for the 2013 end-of-year jacketed CPC-1232 fleet appears to come from an RSI presentation delivered to OMB on June 16, 2014. The car count shown in Table BP-1 differs from this figure due to rounding and due to the inclusion of 123 cars built to the AAR 211 standard, a closely related standard that would require similar modifications under the proposed regulations. We have not been able to identify a source for the assumption that only 5,000 additional cars would be added to the fleet.

Appendix D: Additional Tables – Exhibits B2-B4

Exhibit B2: Cars in Crude and Ethanol Service Idled by Modification Process (Car Years)

Total Fleet Size without Regulation	Total	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Crude Oil		65,991	87,507	87,707	96,522	108,722	119,664	130,853	130,853	130,853	130,853	130,853	130,853
Ethanol		30,749	31,300	31,453	31,876	32,045	32,155	32,418	32,539	33,117	33,117	33,133	33,133
Total Car-Years	1,738,266	96,740	118,807	119,160	128,398	140,767	151,819	163,271	163,392	163,970	163,970	163,986	163,986
Cars Undergoing Modification	**Total**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Crude Oil		0	740	1,608	1,608	601	0	0	386	1,608	1,608	1,608	288
Ethanol		0	0	0	0	418	1,608	1,608	1,238	0	0	0	188
Total Car-Years Lost	15,115	0	740	1,608	1,608	1,019	1,608	1,608	1,624	1,608	1,608	1,608	476
Noncompliant Cars Awaiting Modification	**Total**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Crude Oil		0	0	0	11,704	48,437	43,358	39,797	35,811	27,111	17,119	7,126	7

Exhibit B3: Modification Cost Summary for Cars in Crude and Ethanol Service

$, millions	Total	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Modification Costs	3,028.2	0.0	181.3	314.6	314.6	262.3	314.6	314.6	318.4	314.6	314.6	314.6	63.9

Exhibit B4: Crude and Ethanol Rail Traffic Summary

Without Regulation	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Tank Cars Dedicated to Crude and Ethanol Service, thousands	97	119	119	128	141	152	163	163	164	164	164	164
Carloads, thousands	1,154	1,369	1,375	1,427	1,542	1,645	1,757	1,755	1,764	1,764	1,769	1,764
With Regulation	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Tank Cars Dedicated to Crude and Ethanol Service, thousands	97	118	118	113	68	95	117	127	138	149	159	169
Carloads, thousands	1,154	1,364	1,362	1,255	720	1,007	1,266	1,404	1,525	1,623	1,721	1,812
Decrease Due to Regulation	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Tank Cars Dedicated to Crude and Ethanol Service, thousands	0	1	1	16	72	57	46	36	26	15	5	(5)
Carloads, thousands	0	5	13	171	822	638	491	351	240	141	48	(48)

BEFORE THE
PIPELINE AND HAZARDOUS MATERIALS
SAFETY ADMINISTRATION

DOCKET NO. PHMSA—2012—0082 (HM-251):
HAZARDOUS MATERIALS: ENHANCED TANK
CAR STANDARDS AND OPERATIONAL CONTROLS
FOR HIGH-HAZARD FLAMMABLE TRAINS

COMMENTS OF THE
ASSOCIATION OF AMERICAN RAILROADS

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September 30, 2014

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Attachment B: J. Brosseau, "Analysis and Modeling of Benefits of Alternative Braking Systems in Tank Car Derailments," Transportation Technology Center, Inc., R-1007 (September 2014)

Attachment C: P. French, Association of American Railroads, Spreadsheets

Attachment D: Letters from Secretary Foxx, April 9 and July 11, 2014

BEFORE THE
PIPELINE AND HAZARDOUS MATERIALS
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DOCKET NO. PHMSA—2012—0082 (HM-251):
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CAR STANDARDS AND OPERATIONAL CONTROLS
FOR HIGH-HAZARD FLAMMABLE TRAINS

COMMENTS OF THE
ASSOCIATION OF AMERICAN RAILROADS

The Association of American Railroads (AAR),[1] on behalf of itself and its member railroads, submits the following comments in response to the notice of proposed rulemaking (NPRM) on requirements for the transportation of flammable liquids by rail.[2] AAR's member railroads account for most of the rail transportation of flammable liquids and have a substantial interest in the proposed tank car standards and operating requirements.

I. Introduction

AAR has been eagerly awaiting the notice of proposed rulemaking on tank car standards. In 2011, AAR petitioned PHMSA to adopt new tank car standards for packing group I and II materials, including flammable liquids. In comments responding to the 2013 ANPRM, AAR endorsed new tank car standards for all class 3 flammable liquids, including those classified as packing group III. AAR strongly supports new tank car standards for all class 3 flammable liquids.

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[1] AAR is a trade association whose membership includes freight railroads that operate 83 percent of the line-haul mileage, employ 95 percent of the workers, and account for 97 percent of the freight revenues of all railroads in the United States; and passenger railroads that operate intercity passenger trains and provide commuter rail service.

[2] *See* 79 Fed. Reg. 45,016 (August 1, 2014). AAR is filing separate comments on the issue of providing crude oil routing information to State Emergency Response Commissions.

However, PHMSA has proposed additional requirements that, if adopted, would have a devastating impact on the railroads' ability to provide their customers with efficient rail transportation. In particular, the proposals for significantly more stringent speed limits than in place today and electronically-controlled pneumatic (ECP) brakes could dramatically affect the fluidity of the railroad network and impose tremendous costs without providing offsetting safety benefits.

AAR and its member railroads have a record of putting safety first and taking action to enhance the safe transportation of hazardous materials, including flammable liquids. It is in that spirit that AAR files these comments on the NPRM. AAR has long been an advocate of improved tank car designs. But putting in place more stringent speed restrictions and requiring ECP brakes is not in the public interest. The result would be reduced network fluidity and traffic moving off rail lines onto less safe modes of transportation.

The railroads have taken significant steps to enhance the safety of hazardous materials transportation. The railroads' approach to hazardous materials transportation safety has three prongs. One is to enhance operating and infrastructure maintenance practices to reduce the probability of an accident occurring. The second is to strengthen the ability of tank cars to withstand an accident without a breach. The third is to enhance the ability of railroads and public officials to respond to a release of a hazardous material.

The railroads have instituted a number of measures to reduce the probability of an accident occurring. In August 2013, AAR expanded the application of its recommended operating and maintenance practices for hazardous materials, embodied in Circular OT-55, to any train with 20 or more loaded cars containing hazardous materials, including flammable liquids. These voluntary measures include a maximum speed of 50 mph, passing restrictions, the placement of defective bearing detectors along the right-of-way, and enhanced track inspections.[3]

Furthermore, as set forth in a February 20, 2014, letter sent by Secretary Foxx to AAR, the Class I railroads committed to Secretary Foxx that they would institute special requirements for Key Crude Oil Trains (trains with at least 20

[3] AAR, Circular OT-55-N, "Recommended Railroad Operating Practices For Transportation of Hazardous Materials," www.regulations.gov, Document No. PHMSA-2012-0082-0009 (Aug. 15, 2013).

carloads of crude oil).[4] Specifically, the railroads committed to conducting route analyses for Key Crude Oil Trains in order to select the routes posing the least overall safety and security risk; limit Key Crude Oil Train speeds in High Threat Urban Areas (HTUAs) to 40 mph if the train has a legacy DOT-111 car with crude oil; use distributed power or 2-way end-of-train devices; perform additional track inspections; install wayside detectors every 40 miles, unless track configurations or safety considerations dictate otherwise; inventory emergency response resources; and spend $5 million in 2014 on training emergency responders, including the development of a crude oil emergency response training program at AAR's Transportation Technology Center, Inc., (TTCI) and funding for emergency responders to attend the program, as well as a module for field training. The railroads have honored their commitment to Secretary Foxx.

With respect to tank cars standards, in 2011 AAR adopted its own, more stringent interchange standards for tank cars used to transport crude oil and ethanol, embodied in AAR Circular CPC-1232, effective for cars ordered after October 1, 2011.[5] That same year, AAR petitioned PHMSA to upgrade the tank car specification for packing group I and II materials.[6] In comments submitted on the 2013 ANPRM, AAR again sought more stringent tank car standards for packing group I and II materials and flammable liquids.[7]

The third prong of the railroads' initiatives, emergency response, is addressed by the Advance Notice of Proposed Rulemaking also issued by PHMSA on August 1. In addition to the emergency response measures addressed in Secretary Foxx's February 20 letter, the railroads continue to train approximately 20,000 emergency responders annually. Furthermore, in October AAR will be unveiling a new system enabling emergency responders to obtain information on the hazardous materials in a train through an app. AAR more fully discusses emergency response issues in its comments responding to the ANPRM.

The railroads' safety record demonstrates that these and other measures have borne fruit. The context for this rulemaking proceeding is a railroad industry that is continuously improving its overall safety record and its hazardous materials transportation record in particular. According to Federal Railroad Administration (FRA) statistics, the rate of train accidents per million train miles has dropped 42 percent since 2000, from 4.13 to 2.41. In the same time period, railroad employee

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[4] *See* http://www.dot.gov/briefing-room/letter-association-american-railroads.
[5] www.regulations.gov, Document No. PHMSA-2012-0082-0020.
[6] P-1577, www.regulations.gov, Document No. PHMSA-2012-0082-0005.
[7] www.regulations.gov, Document No. PHMSA-2012-0082-0090 (Nov. 14, 2013).

casualty rates have shown a similar decline, dropping from 3.44 casualties per 100 full time employees annually to 1.84.[8] Since 2000, the rate of train accidents with a release for every thousand carloads of hazardous materials transported has declined 62 percent, from 0.020 to 0.008. Looking at the record from another perspective, 99.997 percent of hazardous materials cars are transported to destination without a release.[9]

The NPRM proposes major new requirements in four areas: (1) speed restrictions; braking systems; routing analyses; and tank car specifications. AAR summarizes the major sections of its comments on each of these areas below.

Section II (*operating restrictions*) describes the severe operational concerns should PHMSA decide to impose speed restrictions beyond the HTUAs. Expanded speed restrictions would degrade the fluidity of the rail network. Network fluidity is important not only because it improves the quality of service to customers and lowers costs; it is also important because it enhances the overall safety of the transportation network and reduces the environmental impact of transportation. Ill-advised action by PHMSA to lower the speed limit would inevitably have a ripple effect on other traffic (that PHSMA admittedly ignores). The result would be the diversion of traffic off the rail network and onto less safe and less environmentally friendly modes of transportation.

Section III (*ECP brakes*) describes the substantial flaws in the justification for mandating the use of ECP brakes for the transportation of flammable liquids. The technology is not widely used in the industry. The Federal Railroad Administration (FRA) already undertook a rulemaking proceeding on ECP brakes just six years ago in which it concluded that it could not justify mandating ECP brakes. In this section, AAR respectfully urges PHMSA to show the same wisdom that FRA showed in 2008.

Section IV (*routing analysis*) of these comments addresses PHMSA's proposal to require routing analyses and require railroads to adjust their routes accordingly. As is the case with speed restrictions, adjusting the routing for too

[8] http://safetydata.fra.dot.gov/officeofsafety/publicsite/summary.aspx (September 2014 data).

[9] AAR Analysis of FRA Train Accident Database as of September 2014. Carloads from ICC/STB Waybill Sample, 1995-2012. For the year 2013, carloads from the BOE Annual Report. Association of American Railroads, Bureau of Explosives, "Annual Report of Hazardous Materials Transported by Rail: 2013," p. 13, Ex. 9 (Report BOE 13-1, July 2014).

many trains when there is no significant safety advantage would also impair network fluidity. In this section, AAR urges PHMSA to limit the adverse impact on network fluidity by restricting the scope of the trains subject to the routing provisions.

Section V (*tank car design*) of AAR's comments addresses AAR's perspective on improvements to the current tank car standards. AAR supports strengthening the standards governing the transportation of flammable liquids. AAR also emphasizes that the new tank car standards should apply to all tank cars transporting flammable liquids, not just those in so-called HHFT trains.

Section VI addresses some miscellaneous concerns, including the pejorative and misleading label chosen by PHMSA to describe trains carrying flammable liquids.

II. Speed Restrictions Could Substantially Impact Network Fluidity

PHMSA has suggested speed restrictions that would substantially impair railroad service without providing substantial safety benefits. Consequently, consistent with the railroads' agreement with Secretary Foxx, PHMSA should go no further than applying a 40 mph speed restriction to HTUAs.

A. Network Fluidity Must be Preserved.

The backdrop for PHMSA's speed limit alternatives is a railroad network that in key places is at or near capacity. An onerous speed limit has the potential to affect significantly the fluidity of the railroad network, to the detriment of freight railroads and their customers, as well as passenger railroads that operate over freight tracks. Indeed, a fluid rail network is also in the public interest from safety, security, and environmental perspectives.

While it is good news for the economy and the railroad industry that railroad business is on the rebound from recession levels, network fluidity has declined. Figure 1 shows rebounding railroad traffic; Figures 2 and 3 show that the network fluidity is suffering due to a number of factors such as a change in the commodity mix.[10] Figure 2 shows that average train speeds over the last year on the major railroads declined and Figure 3 shows that terminal dwell time increased. Figure 4 shows the change in commodity mix.

[10] Figure 1 is based on data from the seven Class I railroads. Figures 2 and 3 are based on data from six of the seven Class I railroads.

Figure 1. Rail Traffic Has Rebounded

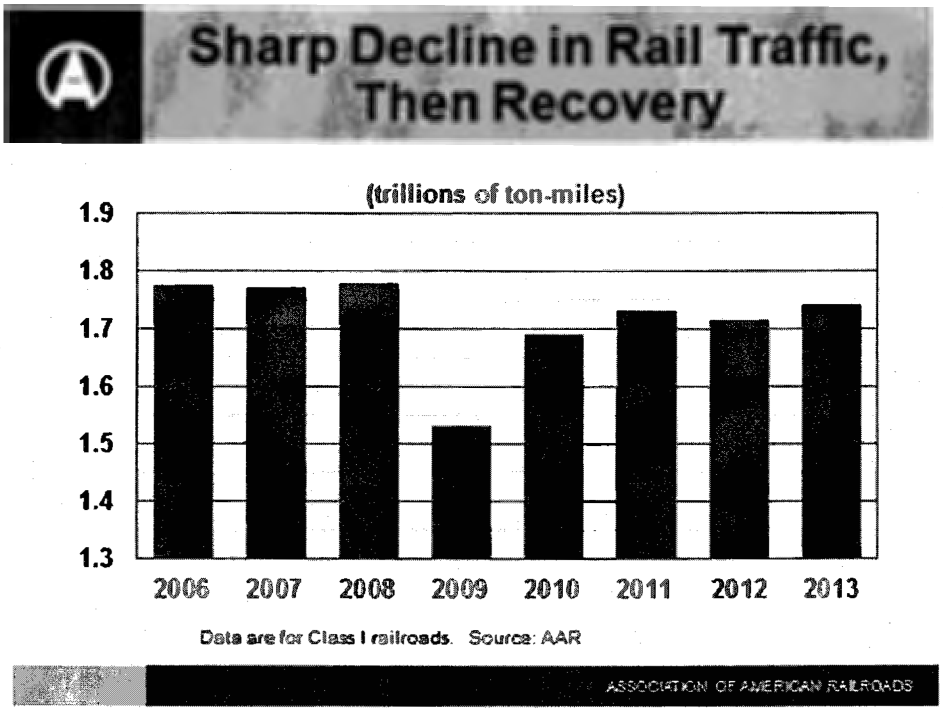


Figure 2. Average Train Speeds Are Declining

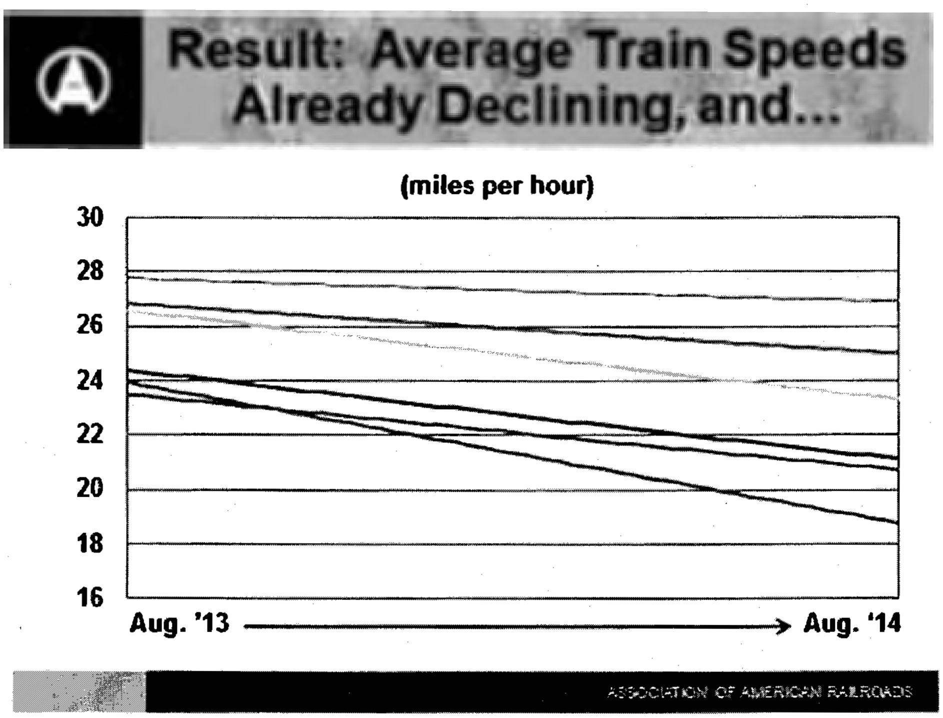


Figure 3. Dwell Time Is Increasing

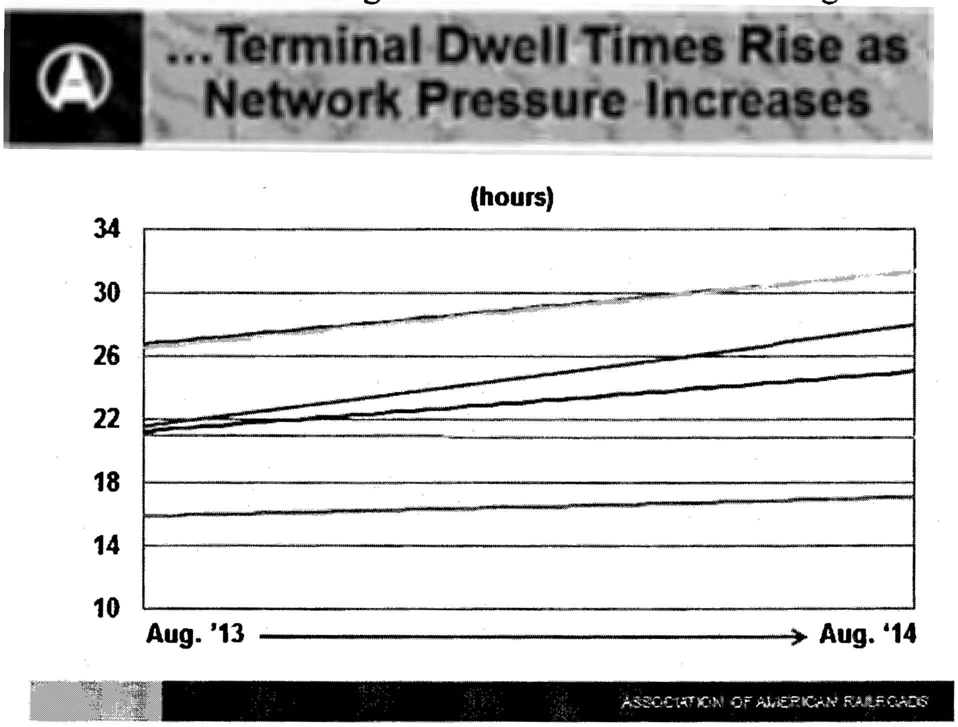
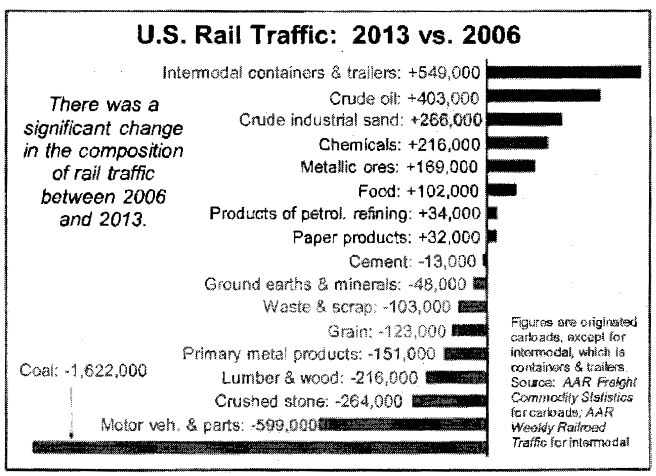


Figure 4. The Traffic Mix is Changing



Onerous requirements to reduce the speed of trains for flammable liquids would affect not only those trains, but other freight and passenger trains as well. The impact on railroad capacity can be compared to traveling on a 2-lane highway. Slowing down one car or truck affects trailing vehicles. Similarly, slowing down one train affects trailing movements, except that the impact on railroad traffic is much worse because the opportunities to pass are much more constrained than on a highway. Trains can pass only at widely-spaced locations on a railroad, whether single or double-tracked. Research on rail capacity has shown, and rail operators have long understood, that reducing speeds reduces network capacity and that heterogeneity in speed exacerbates this effect.[11]

In publishing the NPRM, PHMSA acknowledges its analysis of speed restrictions does "not estimate any effects from speed restrictions on other types of rail traffic throughout the rail network (e.g., passenger trains, intermodal freight, and general merchandise)."[12] This is a glaring omission. The *primary and unavoidable* cost of any speed restriction is a decrease in network fluidity and capacity. Decreased network fluidity results in increased operating costs for all trains that must travel slower because of the slower network. Decreased network fluidity also leads to increased capital costs, as railroads are forced to invest to expand corridors where capacity is constrained because of speed restrictions. Furthermore, decreasing the capacity and efficiency of the railroad network means that significant volumes of railroad traffic will be diverted to the highways. The result would be more highway traffic, more pollution, and an overall decrease in transportation safety.

PHMSA asks if a 40 mph speed restriction is necessary.[13] PHMSA does not need to regulate the speed of flammable liquid trains. There is no demonstration of

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[11] C. Martland, "Railroad Train Delay and Network Reliability," AAR Report R-991 (March 2008); M. Dingler et al., "Effect of train-type heterogeneity on single-track heavy haul railway line capacity," Proceedings of the Institution of Mechanical Engineers, Part F: Journal of Rail and Rapid Transit, DOI:10.1177/0954409713496762 (2013); S. Sogin et al., "Analyzing the Incremental Transition from Single to Double Track Railway Lines," Proceedings of the International Association of Railway Operations Research 5th International Seminar on Railway Operations Modelling and Analysis, Copenhagen, Denmark (May 2013); S. Sogin et al., "Comparison of capacity of single- and double-track rail lines," Transportation Research Record: Journal of the Transportation Research Board 2374: 111-118 (2013).

[12] 79 Fed. Reg. 45,047.

[13] 79 Fed. Reg. 45,047.

a need to do more than the railroads have already done. Circular OT-55 restricts the speed of Key Trains to 50 mph and as discussed earlier, the Class I railroads have voluntarily committed to reducing the speed of Key Crude Oil Trains with at least one legacy DOT-111 tank car to 40 mph in HTUAs. However, AAR does not oppose a speed restriction based on the voluntary actions already taken as long as the restrictions apply on a temporary basis until legacy DOT-111 cars are replaced or retrofitted and network fluidity is maintained. AAR does oppose speed restrictions that would adversely affect network fluidity without providing a significant safety benefit.

Operating restrictions that could adversely affect the railroad's ability to transport goods should be viewed in the context of other restrictions that affect the fluidity of the railroad network. For example, the PTC regulatory scheme also requires reduced train speeds when problems occur with the PTC system.

Reduced network fluidity and capacity are not in the public interest. Railroads not only offer economic advantages, they also are an environmentally superior mode of transportation. An onerous speed limit could result in the diversion of traffic to other modes or prevent additional traffic from being transported on the railroad network.

B. <u>Application of a Speed Limit to Every HHFT as Defined Would Severely Impact the Railroad Network.</u>

In assessing the potential impact of the additional speed restrictions suggested by PHMSA in the NPRM, there is an initial methodological problem. It appears that PHMSA intends for additional speed restrictions to apply only to unit trains: "this rule primarily impacts unit train shipments of ethanol and crude oil."[14] It also appears that PHMSA intended for the speed restrictions to be short-term measures that would be lifted once legacy DOT-111 cars are replaced or retrofitted.

However, PHMSA suggests the application of speed restrictions to high-hazard flammable trains (HHFTs), defined as any train with 20 or more cars containing a flammable liquid. Seemingly contrary to PHMSA's intent to address unit trains, these requirements would apply to manifest trains transporting blocks of flammable liquids that amount to less than 20 tank cars individually, but together exceed the 20-car threshold. There are a considerable number of such trains. In fact, several Class I railroads report that 20 to 60 percent of their trains

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[14] 79 Fed. Reg. 45,017.

containing 20 or more tank cars of flammable liquids are manifest trains, not unit trains.[15]

It appears unlikely PHMSA intended to apply a 40 mph speed limit to any manifest train with 20 or more tank cars containing flammable liquids. In focusing on unit trains, PHMSA clearly is concerned about potential accidents where a significant number of flammable liquid cars are grouped together.

Applying a 40 mph limit to any HHFT, as the term is defined, could dramatically impact the fluidity of the railroad network. Consequently, AAR proposes to limit applicability of a 40 mph speed limit in HTUAs to a train with a single block of 20 or more loaded tank cars containing a flammable liquid when at least one of the tank cars is a legacy DOT-111 tank car. To avoid the theoretical problem of a large number of flammable liquid cars in a train separated so that the 20-car threshold is not met, AAR proposes there be an overall threshold of 35 loaded tank cars, including at least one legacy DOT-111 tank car, whether or not those 35 tank cars are in a single block. Thirty-five tank cars is the threshold PHMSA has used for providing routing information for crude oil shipments to State Emergency Response Commissions.[16]

Using a 20-car block threshold for application of the 40 mph speed limit, subject to an overall threshold of 35 tank cars, is consistent with PHMSA's focus on unit trains. AAR recognizes, however, that the commitment to Secretary Foxx to operate Key Crude Oil trains at 40 mph in HTUAs (if the trains contain a legacy DOT-111 tank car) is not limited to whether the 20 cars are in a block. AAR's members have no intention of going back on that commitment. Therefore, for crude oil only, AAR would not oppose a 40 mph limit within HTUAs if 20 loaded tank cars are in a train and at least one of those cars is a legacy DOT-111 tank car, regardless of whether the 20 cars are in a single block.

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[15] PHMSA implies the NPRM only applies to crude oil and ethanol ("this rule primarily impacts unit train shipments of ethanol and crude oil; because ethanol and crude oil are most frequently transported in high volume shipments"). 77 Fed. Reg. 45,017. Other flammable liquids are transported in trains with twenty or more flammable-liquid cars.

[16] 79 Fed. Reg. 45,041 ("a 1,000,000 gallon threshold for a unit train would require notification . . . for unit trains composed of approximately 35 cars of crude oil").

C. An Expanded 40 MPH Speed Restriction Could Dramatically Impair Railroad Service.

A 40 mph speed restriction expanded beyond HTUAs could be devastating to network fluidity. Freight and passenger service alike would be affected.

Large railroads use a simulation program called "Rail Traffic Controller" (RTC) to measure track capacity and train performance. This software contains two basic types of files: one set represents infrastructure (track, signals, grades, curves, speed limits, etc.); the other set represents trains (type, frequency distribution, lengths, trailing weights, locomotive consists, priority, speed limits, schedule times, etc.). The dispatch logic in the simulation model replicates the logic that train dispatchers use when controlling the flow of trains across a railroad district: this logic has been repeatedly tested against observed reality to ensure that model results accurately predict the consequences that can be expected in day-to-day operations if changes are made to any of the many independent variables that can affect the railroad. Thus, the model can quantify the impact of adding or extending sidings, of adding more double or triple track main line, of increasing train lengths, of adding passenger trains to a freight route, of changing the signal system, or of changing operating practices or rules.[17] One caveat with respect to RTC modeling is that the model assumes perfect dispatching and operations with low variability. Thus, RTC modeling can be somewhat overly optimistic with respect to network fluidity.

In the short time available for modeling, specific corridors were analyzed for the potential impact of a nationwide 40 mph speed restriction. BNSF analyzed segments on its northern and southern transcontinental routes, from Aurora, Illinois, to Vancouver, Washington, and from Kansas City to Los Angeles. On both these routes trains operate at speeds up to 70 mph. A 40 mph speed limit for HHFTs would result in following trains slowing down until the HHFT reached an "overtake" permitting the faster train to pass.

The modeling revealed the severe impact on network fluidity from a 40 mph nationwide speed restriction. On the Aurora – Vancouver segment, one Amtrak schedule would be 22 minutes slower than at present. The impact on freight trains would be greater; intermodal trains would lose more than 1.5 hours and other

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[17] The railroads recognize that they have unique modeling capability. Should PHMSA so desire, they would be pleased to explain in more detail their modeling capabilities and conduct additional modeling for PHMSA. The railroads' modeling was limited by the short time available.

freight trains would lose almost three hours. The potential impact on the Kansas City – Los Angeles route would be even greater. Currently, ethanol constitutes the primary flammable liquid traffic on the KC – LA route. BNSF believes crude oil will begin to move on this route, increasing the number of trains subject to the 40 mph restriction. Furthermore, the Kansas City – LA route is more susceptible to delays from a 40 mph restriction because a greater number of trains are subject to the 40 mph restriction and because there are twice as many trains on that route as on the northern route. BNSF estimates that overall, a nationwide 40 mph speed restriction could result in an 8 percent loss of capacity on the BNSF network, up to a 65 percent loss of capacity on some subdivisions and routes.

Union Pacific ran over 300 simulations on seven corridors using RTC. These simulations found impacts ranging as high as 5 mph on overall train speed (not just HHFTs). On many subdivisions, because of the impact on network fluidity all capacity for additional trains would be lost; on other subdivisions, much of the "excess" capacity that exists today would be lost.[18]

It should be noted that a speed limit could have impacts other than network fluidity. Both CSXT and the Alaska Railroad have noted they would need to establish new crew change points because on certain routes their crews will not be able to make an entire trip to long-standing, previously-established crew change points.

D. <u>PHMSA Should Apply the 40 mph Speed Restriction Only to HTUAs</u>.

Given the dramatic effect speed restrictions can have on railroad service, they should be imposed with caution. It is not in the public interest to make railroad service less efficient and more expensive.

The 40 mph speed restriction for HTUAs for Key Crude Oil Trains, as set forth in Secretary Foxx's February 20 letter, addresses the cities with the largest populations that have been identified as facing the most risk. There is nothing in the record showing a need to expand speed restrictions beyond HTUAs.

PHMSA's own analysis supports applying the proposed 40 mph speed restriction for HHFTs to HTUAs only. Table 6 in the NPRM contains PHMSA's analysis of the 20-year costs and benefits of the various tank car and speed restriction options set forth in the NPRM.[19] Using the midpoint of the benefit

[18] Union Pacific used the Train Performance Simulator along with RTC to model the impact of speed restrictions.
[19] *See* 79 Fed. Reg. 45,022.

range for each option in the table, the most effective option from the perspective of PHMSA's cost-benefit analysis, regardless of the tank car standard chosen, is the HTUA option.

Consequently, AAR does not oppose applying the 40 mph speed restriction for HHFTs to HTUAs, consistent with existing DOT policy (and subject, of course, to limiting the trains subject to the speed restriction as discussed in section II.B above).

E. PHMSA's Analysis of the Proposed Benefits of Speed Restrictions Is Inconsistent with Other Analysis.

PHMSA asserts that "a 40-mph speed limit, from 50-mph, will reduce the severity of a HHFT accidents [*sic*] by 36 percent, due to the reduction in kinetic energy by 36 percent."[20] PHMSA made similar claims with respect to ECP brakes, which AAR debunks later in these comments. In the short time available, AAR did not have time to undertake analysis of this claim. However, work by the University of Illinois calls into question the accuracy of this assertion, or at least its significance.

In 2011, the University of Illinois published the results of a regression analysis of the relationship between track class, train derailment speed, and accident severity for mainline derailments on Class I railroads.[21] The methodology used by the University of Illinois permits an analysis of the relationship between speed and the number of cars derailing. AAR asked the University of Illinois to use its methodology to examine the effect of reducing train speed from 50 mph to 40 mph. The University of Illinois found that the reduction in train speed reduces the number of cars derailed, not necessarily releasing contents, from an average of 12.4 to 11.1.

AAR suggests that reducing the average number of cars derailed in an accident by 1.3 does not justify significantly reducing the ability of the nation's railroads to provide the service their customers expect. Expanding the speed limit restriction beyond HTUAs cannot be justified.

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[20] 79 Fed. Reg. 45,047.

[21] X. Liu at al., "Analysis of Derailments by Accident Cause: Evaluating Railroad Track Upgrades to Reduce Transportation Risk," Transportation Research Record: Journal of the Transportation Research Board, No. 2261, pp. 178-185 (2011).

III. ECP Brakes Should Not be Mandated

AAR strongly opposes any requirement to use ECP brakes. ECP brakes would be extremely costly without providing an offsetting benefit. Furthermore, PHMSA's speculation about safety benefits associated with ECP brakes amounts to nothing more than that; the analysis in the rulemaking docket is substantially flawed.

This is the second time within a decade that DOT has sought to impose ECP brakes on the railroad industry. As FRA admitted in proposing ECP brake regulations in 2007, the agency "has been an active and consistent advocate of ECP brake system implementation."[22] However, underlying the drive for ECP brakes is the lack of safety justification.

In the 2007-2008 ECP rulemaking proceeding, FRA could not justify requiring ECP brakes on a cost-benefit basis and thus did not mandate their use. Instead, FRA offered the industry incentives in the form of regulatory relief.[23] Significantly, FRA recognized that ECP brakes were limited in the effect they could have on accidents. FRA stated that "at speeds greater than those on class 1 track (maximum train speed of 10 mph) or track class 2 (maximum speed 25 mph), the engineer will not have enough reaction time to prevent a collision, even with ECP brakes."[24]

In its Regulatory Analysis for its 2008 ECP rule, FRA postulated $190 million in safety and environmental benefits over a 20-year period. In contrast, FRA estimated the costs would be $1.7 billion, a cost/benefit ratio of almost 9 to 1.[25] FRA assumed that business benefits would more than compensate for the costs of ECP brakes, but industry to this day has not identified business benefits that would justify transitioning to ECP brakes. Note that FRA's estimated costs were based on a limited number of trains using ECP brakes as a result of the incentives FRA offered.

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[22] 72 Fed. Reg. 50,820 (Sept. 4, 2007).

[23] *See* the final rule at 73 Fed. Reg. 61,512 (Oct. 16, 2008).

[24] FRA, "Electronically Controlled Pneumatic Brake Systems -- Final Rulemaking -- Regulatory Analysis, www.regulations.gov,, Document No. FRA-2006-26175-0065, p. 32 (June 2008).

[25] FRA, "Electronically Controlled Pneumatic Brake Systems -- Final Rulemaking -- Regulatory Analysis, www.regulations.gov, Document No. FRA-2006-26175-0065, pp. 4, 5, (June 2008).

Although the fundamental economics of ECP brakes has not changed, a scant six years later, DOT is again raising the issue of requiring ECP brakes. Apparently, the rationale for this proceeding is not that ECP brakes would help avoid accidents. Rather, the rationale is that the consequences of accidents would be mitigated by resulting in fewer cars being punctured.

The shift in rationale for ECP brakes, however, has led to the same result – DOT cannot justify an ECP mandate. The discussion of ECP brakes in the NPRM is faulty with respect to both costs and benefits.

A. <u>Analysis Does Not Support the Purported Benefits of ECP Brakes.</u>

FRA's conclusions about the effectiveness of ECP brake systems are based on modeling analysis by Sharma & Associates, Inc.[26] Based on Sharma's work, PHMSA concludes that ECP brakes would "have 36 percent fewer car puncture [*sic*] compared to the same train without ECP brakes."[27] The estimate of a 36 percent reduction in accident severity is based on the reduction in the kinetic energy of the tank cars trailing the point of derailment. However, as will be shown, ECP brakes would have a minimal impact on the severity of a derailment.

Sharma's estimated reduction in the kinetic energy upon which PHMSA bases its premise of the effectiveness of ECP brakes is based on a very limited set of simulations and looks only at derailments that occur at the head end of a train. Sharma states that, "given that this is based on a limited simulation set, the results could be optimistic, and should be taken with a grain of salt…it is anticipated that the percent improvement due to ECP would likely drop to about 25%..."[28] There is no indication of how the 25 percent estimate was derived, but the wide range of reported estimates for potential reduced accident severity with ECP brakes suggests a more complete analysis with validation against actual events is necessary to understand the actual potential benefit.

Another problem with the Sharma analysis is the bias resulting from limiting the analysis to trains with 80 cars. The result is likely a bias that overestimates the effect of ECP brakes. When conventional brake systems are used, the longer the

[26] Sharma & Associates, "Objective Evaluation of Risk Reduction from Tank Car Design & Operations Improvements," <u>www.regulations.gov</u>, Document No. PHMSA-2012-0082-0209 (July 2014) (hereinafter Sharma & Associates).
[27] "Calculating Effectiveness Rates for Emergency Brake Signal Propagations Systems," <u>www.regulations.gov</u>, Document No. PHMSA-2012-0082-0210, p. 3 (July 2014) (hereinafter referred to as Calculating Effectiveness Rates).
[28] Sharma & Associates, p. 13.

train the longer the period for all the train brakes to be applied. Additionally, the deceleration effects of other cars blocking the motion of a car and the ground will be comparatively less for a longer string of cars since the residual mass behind the point of derailment will be larger.[29]

AAR's Transportation Technology Center, Inc., undertook its own modeling of the effect of ECP brakes, with an independent review by Applied Research Associates, Inc. (ARA).[30] TTCI used the Train Operations and Energy Simulator (TOES™) model that has been in use for nearly 30 years, has been validated many times over, and is considered an industry standard for train dynamics modeling. TTCI's study examined several of the derailments cited in the NPRM, as well as other similar types of derailments to develop and validate a methodology for estimating the potential reduction in accident severity. TTCI's methodology uses output from TOES to model the contribution of the braking system and other forces acting on the train in dissipating the energy in the train.

TTCI's analysis considered a number of factors that do not appear to be analyzed by PHMSA or Sharma, including:[31]

- *The magnitude of the force applied to the cars trailing the point of derailment.* There is a considerable amount of force that works to decelerate the mass of the cars trailing the point of derailment due to the blockage resulting from the derailment itself, which significantly limits the potential contribution from any braking system. In addition, as Sharma acknowledges, friction from the ground needs to be taken into account. However, Sharma does not adequately take friction provided by the ground into account. Sharma uses coefficients of friction between 0.27 and 0.33.[32] ARA demonstrates that those coefficients are far too low and differ from

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[29] S. Kirkpatrick, Applied Research Associates, Inc., "A Review of Analyses Supporting the Pipeline and Hazardous Materials Safety Administration HM-251 Notice of Proposed Rulemaking, p. 6 (Sept. 29, 2014) (Attachment A) (hereinafter referred to as Kirkpatrick).
[30] J. Brosseau, "Analysis and Modeling of Benefits of Alternative Braking Systems in Tank Car Derailments," Transportation Technology Center, Inc., R-1007 (September 2014) (Attachment B) (hereinafter referred to as Brosseau).
[31] *See* Brosseau, pp. 1, 2.
[32] Sharma & Associates, p. 5.

previously published work, including research conducted by DOT's Volpe Center.[33]

- *The potential for a derailment to occur anywhere within the train.* The maximum potential benefit of a given braking system is when the derailment occurs at the head end of the train. Extensive statistical analysis of FRA data shows that the point of derailment is in the first 10 positions of the train in only 25 percent of derailments; in the remaining 75 percent of derailments the point of derailment is distributed evenly throughout the remainder of the train.[34] Recognizing that the benefit will vary depending on the point of derailment in the train, derailments that occur at various points in the train must be considered in order to assess the potential benefit of alternate braking systems. Modeling only derailments that occur near the front of the train overstates the effects of brakes on derailment severity, thereby overestimating the effect of ECP brakes.

- *The variability in the response of a train to various types of derailments.* There are a wide variety of types of derailments and derailment causes and, while certain types of derailments will result in a pile up of cars at the point of derailment, others will have far less dramatic results. Both the point of derailment and the distribution of the number of cars derailed are strongly affected by the derailment cause.[35] The effect of a braking system on derailments in which a pileup does not occur is more difficult to quantify, but should be recognized in an assessment of the potential reduction in accident severity.

TTCI's approach was validated using event recorder data from remote distributed power locomotives involved in derailments such as the Aliceville, Alabama, derailment cited in the NPRM. The event recorders provided accurate rear-of-train speed profiles to validate TTCI's approach. The speed profiles and

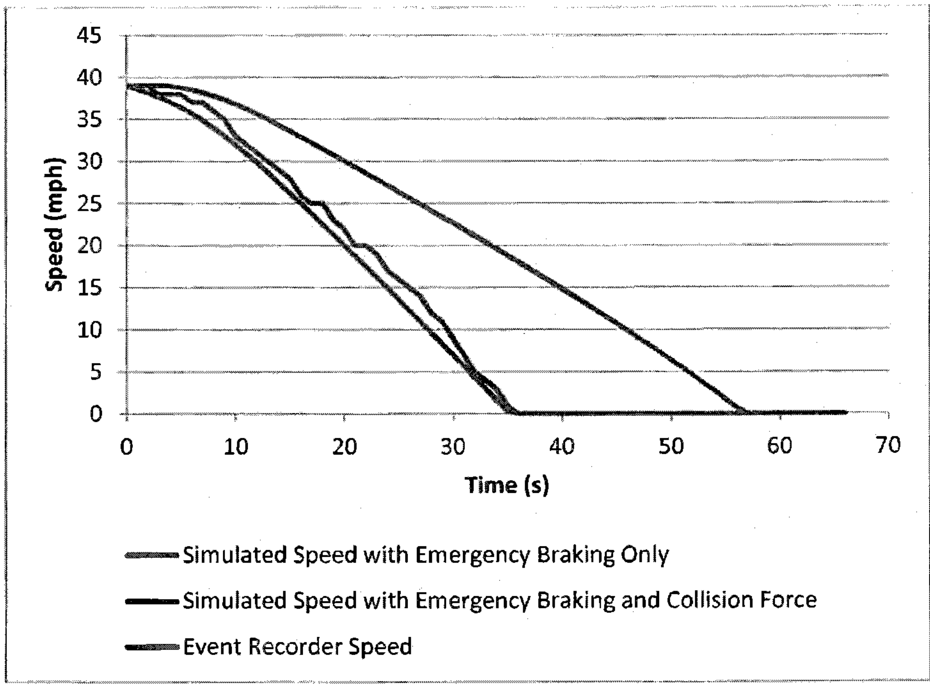
[33] Kirkpatrick, pp. 3, 4.

[34] X. Liu et al., "Probability Analysis of Multiple-Tank-Car Release Incidents in Railway Hazardous Materials Transportation," Journal of Hazardous Materials, Vol. 276, pp. 442-451 (2014) (hereinafter referred to as Liu); R. Anderson and C. Barkan, "Derailment Probability Analyses and Modeling of Mainline Freight Trains," Proceedings of the Eighth International Heavy Haul Conference, Rio de Janeiro, pp. 491–497 (June 2005.)

[35] Barkan et al., "Railroad Derailment Factors Affecting Hazardous Materials Transportation Risk," Transportation Research Record: Journal of the Transportation Research Board, No. 1825, pp. 64-74 (2003); Liu, pp. 442- 451.

stopping distances modeled compare well to the data from these actual derailments, as shown in Figure 4 below, which compares the speed profile from the event recorder of the remote distributed power locomotive in the Aliceville, Alabama, derailment with the simulated speed accounting only for emergency braking and the simulated speed accounting for emergency braking and the collision force. Figure 4 shows that TTCI's simulated speed, taking into account emergency braking and the collision force, closely tracks the speed shown by the event recorder.

Figure 4. Simulated Train Speed v. Recorded Speed[36]



TTCI's model concludes that if ECP brakes had been used in Aliceville, the energy in the derailment would have been reduced by only 12 percent, as compared to the distributed power that was actually used on that train. The model predicts that only 1.5 fewer cars would have reached the point of derailment with ECP brakes.

TTCI conducted 420 simulations that covered the following parameters:[37]

- Train speed at derailment – speeds of 30, 35, 40, 45, and 50 mph were included.

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[36] Brosseau, p. 5.
[37] Brosseau, pp. 2, 3.

- Point of derailment within the train – derailments occurring at the head-end, 1/4-way through the train, 1/2-way through the train, and 3/4-way through the train were included.
- Track grade – grades of 1% uphill, 1% downhill and flat (0%) were included.
- Brake system – conventional (head-end), conventional with end-of-train device (ETD), rear-end distributed power (DP), mid-train DP with ETD, DP at 2/3 with ETD, ECP, and ECP with rear-end wired DP were included.

The result of the modeling and analysis effort can be seen in Table 1, which compares the average percent reduction in energy and the average reduction in number of derailed cars utilizing ECP brakes as compared to other braking systems.

Table 1. Effect of ECP Brakes vs. Conventional Systems on Derailments[38]

Braking System Compared to ECP Brakes	**Average % Reduction in Energy Consumed in Derailment From ECP Brakes**	**Average Reduction in Number of Cars Derailed Using ECP Brakes**
Conventional Brakes (Head-end)	13.3%	1.6
Conventional Brakes with ETD	11.6%	1.3
Rear-end Distributed Power	12.8%	1.5
Mid-train Distributed Power	10.5%	1.2
Distributed Power at 2/3	10.8%	1.2

[38] Brosseau, p. 3.

As Table 1 indicates, the study estimates that ECP brakes will reduce the number of derailed cars by fewer than two cars, on average, compared to other braking systems. This analysis investigates only derailments that result in a significant blockage at the point of derailment and, therefore, likely overestimates the overall potential benefit, considering other types of derailments. For example, braking systems would not be expected to have as much of an effect where no pileup occurs.

Of course, the number of cars derailing is not the same as the number of cars releasing. The conditional probability of release (CPR), the probability of a release if a tank car is in an accident, will depend on the specific specification selected by PHMSA. For example, if the CPR is 5 percent that means there will only be a 5 percent chance of a release from the 1.2 to 1.6 cars derailing due to the absence of ECP brakes, everything else being equal.

Sharma does acknowledge its work is preliminary. In fact, Sharma says that it expects the anticipated improvement from ECP brakes would drop with further simulations and, again, states that its results "should be taken with a grain of salt."[39] These statements certainly add to the suspicion that it is inappropriate to impose a huge expense on industry on the basis of the preliminary analysis done to date.

B. PHMSA Has Substantially Understated the Costs of ECP Brakes.

PHMSA's assessment of the costs of ECP brakes is based on a flawed 2006 study.[40] The 2006 study's estimates significantly understate the costs of ECP brakes.

To begin, ECP brakes would have to be installed as an overlay system, i.e., rolling stock equipped with ECP brakes must be equipped to operate with conventional air brakes and in ECP mode. Freight trains can operate in ECP mode only if all the equipment in a train can operate in ECP mode. Indeed, PHMSA proposes to require railroads to operate in ECP mode only when a train consists solely of tank cars equipped with ECP brakes (under Option 1). Consequently, a tank car equipped with ECP brakes also must be equipped to operate in conventional air brake mode.

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[39] Sharma & Associates, p. 13.

[40] Booz Allen Hamilton, "ECP Brake System for Freight Service: Final Report," www.regulations.gov, Document No. FRA-2006-26175-0015 (May 2006) (hereinafter referred to as Booz Allen).

Clearly, from an operational perspective, were tank cars required to have ECP brakes they also would need to be equipped with conventional braking capability. For example, a railroad might not have an ECP-equipped locomotive available to pick up a block of ECP-equipped tank cars. Or an ECP-equipped tank car might have to be set out from a train and there might not be an ECP-equipped locomotive available to pick the tank car up. The operational challenge of having separate ECP and conventional braking fleets would be daunting, adversely affecting the velocity of the railroad network.

In its cost-benefit analysis, PHMSA confusingly used both stand-alone and overlay numbers. For the cost of equipping a new tank car, PHMSA used the 2006 report's stand-alone estimate, $3,000; PHMSA ignored the report's estimate that an overlay system would cost an additional $1,500. For the cost of retrofitting a car, PHMSA used the 2006 report's overlay estimate, $5,000.[41]

Furthermore, the estimates are far too low. AAR estimates the cost would be $9,665 per car, for both tank cars and buffer cars.[42] Attachment C, enclosed, contains spreadsheets with AAR's calculations. PHMSA estimates 66,000 tank cars would have to be retrofitted.[43] Assuming, *arguendo*, that PHMSA's estimate of the number of cars needing retrofitting is correct, PHMSA has underestimated the cost of retrofitting tank cars with ECP brakes by approximately $176 million.[44]

PHMSA also underestimates the cost of equipping locomotives with ECP brakes. Locomotives, too, would need to be dual equipped. PHMSA estimates the cost to be $79,000 per locomotive. AAR estimates the cost per locomotive to be $88,300. The significance of this difference is magnified by the discrepancy in the number of locomotives that would need to be equipped. PHMSA estimates that only 900 locomotives would be equipped with ECP brakes and that all locomotives

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[41] Booz Allen, pp, III-1, III-2.

[42] AAR does not differentiate between new cars and retrofitted cars insofar as the cost of applying ECP brakes is concerned.

[43] Pipeline and Hazardous Materials Safety Administration, "Draft Regulatory Impact Analysis - Hazardous Materials: Enhanced Tank Car Standards and Operational Controls for High-Hazard Flammable Trains; Notice of Proposed Rulemaking, www.regulations.gov, Document No. PHMSA-2012-0082-0179, pp. 91-93 (July 2014) (hereinafter referred to as Regulatory Impact Analysis).

[44] Apparently, PHMSA omitted to include in its cost calculations the 15,450 new cars that would be needed to replace the tank cars PHMSA postulates would be used exclusively in Canadian oil sands service.

will be equipped in the first year.[45] The railroads expect that they would need to equip most, if not all, of their line-haul locomotives with ECP brakes, a number approaching 20,000, in order to maintain operational flexibility. The difference between PHMSA's and AAR's estimate for equipping locomotives is approximately $1.7 billion.

In addition to underestimating equipment costs, PHMSA underestimates training costs by approximately $215 million. First, PHMSA uses labor rates (cost per hour worked, including fringes) too low for engineers and conductors. PHMSA uses $49.97 for engineers and conductors; AAR estimates the labor rates for engineers and conductors are $73.10 and $62.16, respectively. Second, PHMSA did not account for the training of any carmen. All 9,849 carmen on the Class I railroads would need training. Third, PHMSA assumed only 4,500 engineers and the same number of conductors would need to be trained. To ensure network fluidity, all 27,143 engineers and 41,015 conductors on the Class I railroads would need training.[46] Thus, PHMSA underestimated training costs by $215 million.

Without even considering buffer cars, PHMSA has underestimated the cost of ECP brakes by over $2 billion. That also does not include any additional maintenance expenses for ECP brakes. Precisely identifying the railroads' experience with maintaining ECP systems is problematic because the industry does not use ECP-specific job codes for repairs. However, the railroads' experience is that ECP brake systems require more maintenance than conventional braking systems. AAR estimates that over a 5-year period ECP brakes cost an extra $87 per car to maintain.[47] AAR also expects that over a longer period of time ECP brakes will incur maintenance costs that conventional systems will not, specifically the replacement of batteries, cabling, connectors and other ECP specific hardware. None of these costs were considered by PHMSA.

PHMSA has not accounted for two other unquantifiable factors that could have a significant adverse impact on the railroads. A mandate to install ECP brakes on a large amount of rolling stock in a short period of time might strain

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[45] Regulatory Impact Analysis, p. 154.

[46] Employment numbers from 2013.

[47] AAR estimates $11 in maintenance costs for pneumatic brakes, based on its car repair billing database, which includes parts and labor. For ECP brakes, AAR has more limited data, but based on the experience of one railroad that has been using them for several years, AAR estimates the maintenance cost of ECP brake parts is $98 (excluding labor).

supplier capabilities, leading to quality control issues. Costs, too, might skyrocket as a mandate to install ECP brakes could cause ECP suppliers to increase prices. In addition, the railroads are installing PTC on the locomotives that would need to be equipped with ECP brakes. Whether there might be any adverse interactions between these two electronic systems is unknown.

IV. A Vast Expansion in the Number of Trains Subject to Routing Analysis Could Also Impair Network Fluidity

PHMSA proposes to require routing analyses pursuant to Part 172, Subpart I, and require railroads to adjust their routes accordingly. As is the case with speed restrictions, adjusting the routing for too many trains when there is no significant safety advantage would also impair network fluidity.

The Class I railroads have voluntarily been applying the routing requirements to Key Crude Oil Trains as described in Secretary Foxx's February 20, 2014 letter. Applying the routing requirements to other trains containing flammable liquids would significantly expand the number of movements subject to the routing requirements. There are large numbers of these trains. Forcing all these trains onto the same corridors would clog the railroad network, reducing fluidity on those corridors and preventing additional growth in railroad traffic.[48]

PHMSA could limit the adverse impact on network fluidity by restricting the scope of trains subject to the routing provisions as suggested in section II.B.

V. AAR Supports Enhanced Tank Car Standards

As discussed earlier, AAR has been at the forefront in arguing for more stringent tank car standards. AAR is very supportive of bringing this aspect of the NPRM to a rapid conclusion. Below, AAR discusses its perspective on each of the tank car features discussed in the NPRM. However, before doing so there are several important overarching issues that need to be addressed.

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[48] PHMSA asks how the routing of crude oil has changed as a result of railroads voluntarily applying the routing regulations to crude oil shipments. 79 Fed. Reg. 45,042. The railroads have shifted crude oil traffic as a result of the routing analysis. The result undoubtedly would be the same should the routing regulations apply to other flammable liquids.

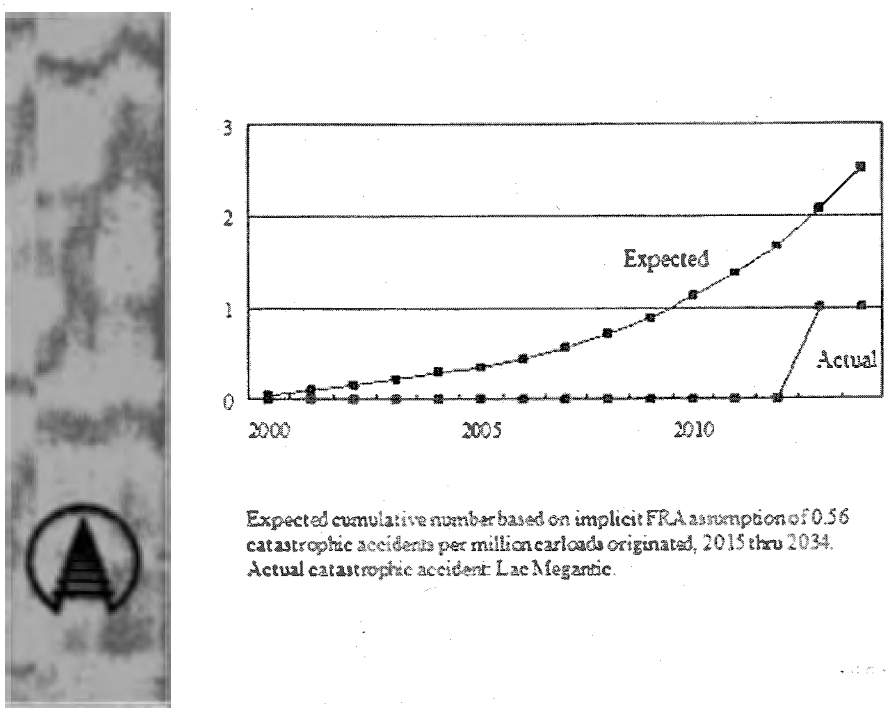
A. <u>The Cost-Benefit Analysis Is Seriously Flawed.</u>

1. <u>There Is No Support for the Projection of Catastrophic Accidents.</u>

PHMSA's speculation that over the next 20 years the U.S. could experience nine events that would have costs exceeding $1.15 billion and one exceeding $5.75 billion is just that – mere speculation. There simply is no basis for such an assumption. Other than Lac-Mégantic, there has been no accident in the catastrophic category.

The railroads' record over the last 15 years does not support PHMSA's speculation. Were the projection of 10 catastrophic accidents over the next 20 years accurate, the catastrophic accident rate would be 0.56 catastrophic accidents per million carloads. If that rate were accurate, there should have been multiple catastrophic accidents in recent years. Figure 5 shows PHMSA's speculation is not borne out by experience.

Figure 5. "Expected" vs. Actual Catastrophic Accidents



2. <u>The Base Case Assumption for PHMSA's Cost-Benefit Analysis Is Flawed.</u>

Another problem with the cost/benefit analysis is that it uses different "base cases" for costs and benefits. PHMSA assumes as its base case for cost purposes that the enhanced CPC-1232 car will be used for all HHFT service by the end of 2018. Then PHMSA calculates that the incremental cost of an Option 1 car is only

$5,000, the difference between the Option 1 tank car and an enhanced CPC-1232 car.

However, for the purpose of calculating benefits, instead of using the enhanced CPC-1232 car as the base case as of the end of 2013, PHMSA uses the existing fleet. In other words, PHMSA measures improvement in puncture resistance using the existing fleet of cars as the base case, most of which are legacy DOT-111 cars.[49]

The difference in base case assumptions makes a very large difference in assessing potential benefits. PHMSA estimates that using Option 1 tank cars instead of the existing fleet would result in a 51 percent reduction in the number of cars releasing flammable liquids in accidents. However, if a fleet composed entirely of enhanced CPC-1232 cars is used as the base case, the improvement from a fleet of Option 1 tank cars shrinks to 10 percent and over 20 years, the present value of the non-ECP benefits from the Option 1 tank car, for low-consequence accidents, drops from $544 million to $164 million; for high-consequence events, the purported benefits drop from $2.4 billion to $1.3 billion.[50] Correction of this base case error results in a reduction in total safety benefits from $3.3 billion to $1.7 billion.

3. PHMSA's Methodology for Assessing Tank Car Performance Is Flawed.

Two different approaches to assessing tank car performance are contained in documents PHMSA put in the regulatory docket. The RIA compares the three tank car options offered in the NPRM by examining the ratio of head puncture velocity and shell puncture force, i.e., this ratio was used to determine the reduction in lading loss. A paper by Sharma and Associates uses derailment simulation to estimate the fraction of impacts that fall above and below the tank's ability to resist the impact force.[51] Both approaches are problematic.

If PHMSA's assessment is based on the ratio of head puncture velocity and shell puncture force, it has erroneously assumed a linear relationship between those parameters and the probability of an accident-caused release. That would only be true if the distribution of the impact force were uniform, which DOT's own analysis shows is not the case.[52] As a result, PHMSA has overestimated the

[49] *See* Regulatory Impact Analysis, pp. 80, 82, 90, 94,120-126.
[50] *See* Regulatory Impact Analysis pp. 120, 186. This reduction in benefits for high-consequence events is calculated using PHMSA's "effectiveness ratio."
[51] *See* Sharma & Associates.
[52] Sharma & Associates, Figure 5, p. 7.

expected number of cars releasing for a given speed, based on Figure 10 in the Sharma and Associates report.

Furthermore, this approach seems to assume that the quantity lost in a derailment is solely a factor of train speed.[53] As discussed further in the section on ECP brakes, more significant is whether derailed cars strike others that are immobilized, like hitting a wall, so that all of the energy goes into damaging the car instead of moving it aside.

If PHMSA's assessment is based on derailment simulations and the distribution of impacts, which appears to be the case at least for the assessment of ECP brakes, flaws in both the simulation of the derailments and in the derivation of release probabilities undermine the credibility of the findings. The most significant problems with the derailment simulations are as follows.

First, although the Sharma Report indicates that the simulation was done in three dimensions for the first 50 cars, the simulation restricted the movement of the couplers and body bolsters to two dimensions, effectively restricting the entire simulation to two dimensions. There can be no override collisions or rollovers unless the tank first separates from the couplers and bolsters, which is uncommon. The distribution of impact loads is therefore artificially restricted by a major modeling assumption that is unacceptably unrealistic. A two-dimension simulation simply does not account for enough of the relevant physics to produce a reliable distribution of impacts.[54]

Second, the derailment modeling does not adequately account for the effect of compressibility of the lading, and therefore all cars are effectively assumed to be empty insofar as the deformation resistance of the tank is concerned (the modeling does account for the weight of a full load). The result of modeling empty cars is to omit the high loads that occur when a loaded tank deforms enough to go shell-full and experiences a spike in both internal pressure and impact forces. As a consequence, the calculated collision force distribution will be incorrect in the analyses. In particular, the distribution would be skewed toward lower force levels.[55]

Third, there is no support for the assumed distribution of impact sizes. The authors claim that it works to validate the observed fractions of cars failing. As

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[53] Calculating Effectiveness Rates, pp. 4 et seq.

[54] *See* Kirkpatrick, pp. 1, 2.

[55] Kirkpatrick, pp. 4, 5

questionable as this claim is, even if it were true it is possible that many distributions would lead to the observed fraction of cars losing lading, and there is no guarantee that in the next analysis this assumed distribution would yield an accurate result unless it reflects reality at least to some degree.

Fourth, Sharma attempts to validate its simulation model primarily by comparing the model's outputs—i.e., the number of cars derailed per train and the number of cars punctured or releasing product, all as functions of train speed — with the equivalent numbers from twelve actual accidents that occurred in the period 2002-2012.[56] The effort at validation fails for a number of reasons.

Sharma did not compare the model's hazmat release or puncture output to a full, representative sample of FRA accident data.[57] In particular, by selecting for comparison only twelve accidents that had at least one car releasing hazardous materials, Sharma increased the average CPR by two or three times.[58] In other words, Sharma "validated" its model against a small, hand-picked set of train accidents that includes a disproportionate number of accidents with an average number of cars releasing product two to three times worse than the average for the full database. Thus, the Sharma simulation model substantially exaggerates, perhaps by a significant amount, the propensity of the tank car fleet to release hazardous material in a derailment. Selection of a biased sample such as this violates a fundamental statistical principle that one use a representative sample of the data. This is a critical flaw that seriously undermines the validity of the results. Sharma, itself, states that "[v]alidation of the model against known historical derailment data is a critical element of the overall methodology."[59]

Sharma does not explain how it selected these twelve accidents for comparison, but they appear to be among the accidents with the highest number of hazardous materials cars derailed and releasing product during that period,

[56] Sharma & Associates, p. 11, Table 2.
[57] Sharma & Associates, p. 13, Figure 10.
[58] AAR's analysis of FRA accident data for the relevant 14-year period, 2000 through April 2014, shows 339 hazmat cars releasing product out of a total of 1,828 hazmat cars damaged or derailed in all accidents at train speeds on main track of 30 mph to 50 mph, for an average CPR of 18.5 percent. However, when only accidents with at least one car containing hazardous materials releasing product under the same circumstances are considered, the CPR increases to 43.0 percent, 2.3 times greater.
[59] Sharma & Associates, p. 2.

especially with respect to ethanol.[60] In these twelve accidents an average of 21 freight cars derailed, 13 of which were hazmat cars, and 9 hazmat cars released product. Sharma's model produced roughly similar results, from which it concluded that the model was valid.

That the twelve accidents chosen for validation are not representative is clear from FRA's database. The average train speed in the twelve accidents was 38 mph; the average mainline speed at derailment in FRA's full accident database from 2003 to 2012 is 26 mph. The twelve accidents averaged 27 freight cars derailed; FRA database shows an average of 11. These are measures of the severity of an accident. Clearly, DOT has introduced a selection bias by looking only at an extreme set of circumstances.

Sharma also attempts to validate its analysis by plotting the number of derailed cars against train speed, claiming that the simulations match actual derailment data. Sharma states that it used FRA's database. However, AAR cannot replicate Sharma's derailment data from FRA's database.[61] Sharma declares its model validated using this approach because it finds its simulation data points fall in the middle of the FRA data set at two train speeds, 30 and 40 mph. No means, medians, or other measures of central tendency and no distributions are provided for the actual FRA data, only for the model simulations. Thus, leaving aside AAR's puzzlement regarding the actual derailment data, there is no way to tell how close Sharma comes to replicating actual derailments.

4. <u>Other Problems with PHMSA's Approach to Assessing the Impact of Tank Car Features on Accidents</u>.

PHMSA's approach to attributing losses to different tank car components is too simplistic. In analyzing the losses of commodities from the twelve accidents studied, PHMSA simply assumes that where there is a loss of a hazardous material from multiple components, which is true of many of the twelve accidents PHMSA chose for analysis, the loss comes equally from each component.[62] That there is no way to determine how much lading each component allowed to escape is no excuse

[60] Sharma refers to twelve accidents, while Calculating Effectiveness Rates refers to eleven accidents. The reason for the inconsistency is not apparent.

[61] *See* Sharma & Associates, pp. 10, 12 (Figure 8).
[62] Calculating Effectiveness Rates, Table 2, pp. 8, 9.

for making an assumption that bears no relationship to reality. For example, top-fitting failures often lead to smaller losses than other component failures.[63]

Compounding the problem with PHMSA's simplistic approach to attributing releases to tank car components is the small sample size of 11.[64] In an accident, the quantity lost is affected in part by the randomness of where (how high) on the tank a failure occurs and how far the car rolls over, which impacts how much of the lading is above any damaged or open fittings, etc. Given the randomness of such events, a small sample will tend to lead to mistaken conclusions.

5. <u>PHMSA Should Have Used a CPR Analysis</u>.

AAR does not understand why PHMSA engaged in problematic analyses about the effectiveness of tank car options when a superior alternative is on the record – CPR analysis using the Railway Supply Institute - AAR Tank Car Safety Research and Test Project (RSI-AAR Project) database. The RSI-AAR Project database contains detailed data on the outcome of tens of thousands of tank car derailments. Each car entered into the database goes through a very careful analysis of DOT Hazardous Materials Incident Reports forms (Form DOT F 5800.1), Chemtrec reports, railroad tank car damage assessment reports, and information about the tank specification. The outcome of the analysis provides a detailed engineering review of damage mechanisms associated with the features of the car in the context of the accident environment that far exceed any derived information from a mere DOT 5800.1 form. The scope of the RSI-AAR Project database assures that virtually all accident environments are taken into account, with appropriate relative frequencies. Using the database to assess the effectiveness of safety benefits of car features that have been in the fleet for an extended period of time, such as thicker tanks, jackets, head shields, and protective housings for top fittings, will be much more precise than modeling. Simply put, CPRs based on the database are the most reliable method available for comparing tank car features and their effects on safety.[65]

The problem with PHMSA's inability to assess the amount of lost commodity from specific tank car components does not affect CPR analysis using

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[63] *See* RSI-AAR Project's Report RA-05-02, "Safety Performance of Tank Cars in Accidents: Probabilities of Lading Loss," (January 2006) (hereinafter referred to as RA-05-02).
[64] Sharma used 12 in Sharma & Associates, PHMSA used 11 in Calculating Effectiveness Rates.
[65] *See* RA-05-02.

the RSI-AAR Project database. Due to the size of the database, there are sufficient numbers of accidents in which all product is released from one component to enable calculations of CPRs for individual components.

Furthermore, the RSI-AAR Project has calculated the CPR for releases greater than 100 gallons to eliminate minor releases from the analysis of alternative tank car features. The railroad and tank car industries use this metric to evaluate tank car designs. When applying CPR for releases greater than100 gallons, it becomes apparent that PHMSA has underestimated the benefits of enhanced tank cars.

In its paper for this docket, Sharma identifies perceived shortcomings with CPR analysis based on the RSI-AAR Project database.[66] Sharma's assertions are without merit insofar as the issues raised in this proceeding are concerned.

First, Sharma observes that database cannot be used to analyze CPR for innovative designs and alternate operating conditions. However, most of the tank car features at issue in this proceeding are designs that have been used and for which there is ample data. Regarding alternate operating conditions, it appears that Sharma is referring to ECP brakes. AAR has shown in these comments that Sharma's analysis of the effectiveness of ECP brakes is deeply flawed.

Second, Sharma states that "risk numbers seem to change with the version of the data/model being used." It is standard practice to refine models and used updated data. AAR explains the changes that Sharma is referring to in footnote 72, below.

Third, Sharma states that CPR analysis "may not have good representation from all potential hazards, particularly low probability-high consequence hazards." AAR does not understand this critique. The database represents the accidents that have occurred over more than 40 years. Sharma evidently is critiquing the database for not containing data on accidents that have not occurred.

Sharma and PHMSA have avoided CPR analysis in favor of much weaker analyses. The public does not stand to benefit from such an approach.

B. <u>Canada and the U.S. Must Harmonize Their Tank Car Standards.</u>

Before turning to the particulars of PHMSA's proposal, AAR wishes to emphasize the importance of PHMSA and Transport Canada coordinating their tank car standards. Transport Canada issued proposed regulatory requirements for

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[66] Sharma & Associates, p. 1.

tank cars transporting flammable liquids on July 18, 2014.[67] PHMSA's proposed regulatory program bears little resemblance to Transport Canada's proposal.

It is critical that Canadian and U.S. tank car standards be very similar, if not identical. The rail network between Canada and the U.S. is seamless. There are myriad trains crossing the border in both directions each day. In particular, there is significant crude oil traffic crossing the Canada/U.S. border.

It is not in the public interest – from either a safety or economic perspective – for Canada and the U.S. to implement tank car standards that will frustrate commerce at the border. Indeed, both countries have recently committed to harmonizing transportation regulations governing hazardous materials. The U.S.-Canada Regulatory Cooperation Council, formed in 2011, was created for the purpose of increasing regulatory cooperation between Canada and the U.S.[68] That same year the Council released a Joint Action Plan identifying specific objectives. One of those objectives is to "work to better align Canadian and U.S. standards on the containment of dangerous goods."[69] Another objective addresses rail safety more broadly, seeking to "align rail safety standards."[70]

If Canada and the U.S. do not align their standards, costs and service could be impacted. An inability to use tank cars authorized in one country to transport flammable liquids in the other could unnecessarily require more tank cars to be built because of an inability to optimize the combined countries' fleet. Potentially, separate Canadian and U.S. fleets could result in shortages of tank cars.

Furthermore, failure to align the standards could result in legacy cars used in one country or the other. That would raise public policy concerns in the country where the legacy cars were used.

Thus, for PHMSA and Transport Canada to proceed along the different paths they have proposed would be antithetical to Administration policy in both countries. AAR urges PHMSA and Transport Canada to coordinate their tank car standards going forward.

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[67] *See* http://www.tc.gc.ca/eng/tdg/clear-modifications-menu-261.htm.

[68] Information on the Council is available at http://www.trade.gov/rcc/.

[69] http://www.trade.gov/rcc/documents/Alignment-of-Dangerous-Goods-Means-of-Containment.pdf,

[70] http://www.trade.gov/rcc/documents/Rail-Safety-Standards.pdf,

C. The Specifications Should Apply to All Cars in Flammable Liquid Service.

As stated in its comments in response to the advance notice of proposed rulemaking, AAR supports requiring the replacement or retrofitting of *all* tank cars in flammable liquid service. PHMSA proposes that the upgraded tank car standards should apply only to cars used in HHFTs. If all tank cars used in flammable liquid service are not required to be retrofitted or replaced, the 40 m.p.h. speed restriction would last in perpetuity since shippers of flammable liquids in blocks of fewer than 20 tank cars arguably might not be required to upgrade their tank cars under the NPRM, yet the NPRM requires railroads to abide by the speed restriction anytime the total number of flammable liquid cars in a train is at or above 20 tank cars.

It would be unprecedented for PHMSA to adopt tank car specifications dependent on the amount of cars in a train. Not only would such an approach be burdensome to the railroads operationally, it would have disparate impacts on shippers and tank car owners. Furthermore, PHMSA would be forgoing the safety benefits of the forthcoming enhanced tank car specifications for a significant portion of the flammable liquid tank car fleet.

Indeed, AAR does not understand how conditioning the tank car specification on whether a tank car would be in an HHFT would work. How would the shipper know if a tank car would be in an HHFT? As proposed, even if a shipper were to tender one tank car, that tank car could end up in a train with 20 or more flammable liquid cars.

D. AAR Supports More Stringent Tank Car Specifications

Separately, AAR is jointly filing comments with the American Petroleum Institute proposing tank car standards. These comments supplement that filing from AAR's perspective.

There are two key considerations in determining the appropriate tank car specifications, CPR and avoidance of a thermal rupture of the tank car. Industry's measure of CPR addresses the chance that there will be a release due to a puncture or a tear should there be an accident and is based on over four decades of data on how tank car features impact the probability of release. The features directly relevant to CPR include shell thickness, jackets, head shields, and top and bottom fittings protection.

The industry uses modeling instead of CPR to analyze the potential for a heat-induced rupture. Industry's tank car database does not contain enough information to address the ability of a tank car to withstand a thermal rupture. The two features most relevant to considering the probability of a heat-induced rupture occurring are the type of thermal protection and the start-to-discharge point and capacity of a pressure relief device.

Following is a discussion of AAR's views of the tank car standard that should apply to the transportation of flammable liquids.

1. The AAR/API Proposals Respond to Secretary Foxx's Request.

On April 9 and July 11, 2014, Secretary of Transportation Anthony Foxx wrote AAR the enclosed letters (Attachment D), asking that the AAR Tank Car Committee, which has representatives from the railroads, shippers, tank car lessors, and tank car manufacturers, reach consensus on a revised tank car design and a retrofit program for the purposes of this rulemaking proceeding. To honor the Secretary's request, AAR discussed the tank car issues with various parties, taking into account all the factors that must be considered in setting tank car specifications.

AAR is pleased to state that it has been able to reach agreement with the American Petroleum Institute (API) on shell thickness and jackets for tank cars. AAR and API suggest that PHMSA adopt a requirement for a ½" shell for new cars for flammable liquid service, plus a 1/8" jacket. A ½" shell combined with a 1/8" jacket (including thermal protection, a full-height head shield, bottom-outlet handle protection, an appropriately-sized pressure relief device, and top fittings protection) provides a low CPR.

For existing tank cars, AAR and API suggest distinguishing between jacketed and non-jacketed cars. Jacketed cars have a relatively low CPR already. AAR suggests that they be retrofitted with an appropriately-sized pressure relief device and bottom-outlet handle protection when shopped or requalified after the effective date of the rule. Non-jacketed cars should be retrofitted to meet the requirements of a CPC-1232 car with a jacket. Such a car would be equipped with a 1/8" jacket, thermal protection, a full-height head shield, an appropriately sized pressure relief device, bottom-outlet handle protection, and valve protection. Such a car would also have a low CPR.

2. AAR Supports an Increase in Shell Thickness for New Tank Cars.

Shell thickness requirements need to be viewed from the perspective that what is feasible for new cars might be infeasible for existing cars. The shell on existing cars, of course, cannot be made thicker. Furthermore, it is not only shells that provide protection against punctures – jackets play a valuable role as well. The thicker the shell/jacket combination, the more an object has to penetrate to create a puncture.

A thicker shell is not always better if it diminishes tank car capacity in a way that is counterproductive. In addition to assessing the overall protection against releases afforded by shell thickness and jackets, tank car specifications need to take into account the need to transport commodities. It is axiomatic that the thicker the shell (or the shell and jacket combined), the lower the CPR. However, at some point extra thickness provides diminishing safety benefits while making rail transportation inefficient and uneconomical by requiring more tank cars to move product. That is not in the national interest. For example, the transportation of crude oil by rail is a critical component of the nation's effort to achieve energy independence. Indeed, in the NPRM PHMSA acknowledges the role railroads play in the transportation of crude oil and ethanol.[71]

Table 2 shows the CPRs for the jacketed and non-jacketed legacy DOT-111 and CPC-1232 cars, and a tank car identical to the jacketed CPC-1232 car but with a ½" shell. The CPR for releases of more than 100 gallons is shown as well as the overall CPR since minor leaks are not the concern addressed by the NPRM.

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[71] *See* 79 Fed. Reg. 45,017.

Table 2.
Conditional Probability of Release for Tank Car Configurations[72]

Car Category	Tank Car Features	CPR (%)	CPR >100 gal. (%)
Legacy DOT 111	7/16" shell	26.6	19.6
	7/16" shell, JKT	12.8	8.5
CPC-1232 DOT 111 without JKT	½" shell, HHS, TFP	13.2	10.3
CPC-1232 DOT 111 with JKT	7/16" shell, JKT, FHS, TFP	6.4	4.6
CPC-1232 DOT 111 with ½" Shell & Jacket	½" shell, JKT, FHS, TFP	5.2	3.7

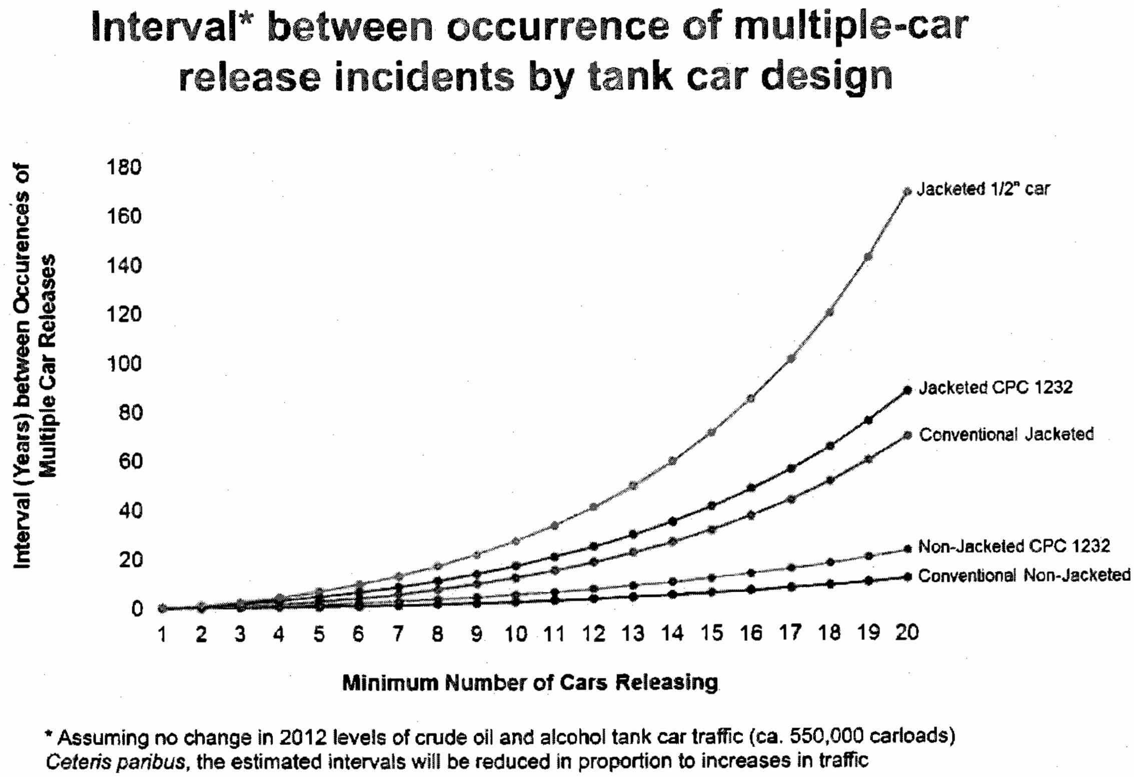
JKT – jacketed; HHS – half-height head shield; FHS – full-height head shield; TFP – top-fittings protection

[72] The CPRs in this table are significantly lower than the CPRs published in RA-05-02. For example, the recalculated CPR for the current DOT-111 tank car without a jacket is 25 percent lower than was calculated in 2006. There are three reasons. One, RA-05-02 used data from accidents that occurred from 1965-1997. The CPRs in Table 2 are based on more recent data, from 1980-2010. More recent data are more likely to be representative of accidents occurring today. Two, Table 2 CPRs were calculated utilizing more factors than were used in RA-05-02, including train speed, derailment severity, tank diameter, and commodity transported. Three, the techniques used for the newer analysis allowed for better handling of some of the complexities of the data that could have masked important relationships in the RA-05-02 analysis.

In addition to looking at CPR for individual cars, the University of Illinois has been examining the possibility of assessing the probability of multiple car releases in an accident. Based on preliminary work, the University of Illinois has posited the frequency with which releases from multiple cars could be expected in an accident from a unit train transporting flammable liquids, assuming all cars in a train were of the same type.[73] Figure 6 below shows that the tank car specification could significantly affect the interval between accidents with multiple car releases. For example, Figure 6 posits that a 20-car release could be expected at an interval of approximately 12 years with a legacy non-jacketed DOT-111 car, while the estimated interval is almost 13 times greater (169 years) with a jacketed ½" car. The interval for the jacketed CPC-1232 car is also significantly lower than for the legacy non-jacketed DOT-111 car, approximately 88 years, 7 times lower than the interval for a legacy non-jacketed DOT-111 car. Significantly, the preliminary analysis is based on historical operating practices and accident rates and does not account for measures taken (other than tank car improvements) to reduce the probability of a release occurring.

[73] For the purposes of the preliminary analysis, the University of Illinois assumed trains transport flammable liquids in unit trains with five locomotives and 80 tank cars.

Figure 6. Interval Between Multiple-Car Releases
From Flammable Liquid Unit Trains



3. <u>AAR Supports Enhanced Top-Fittings Protection, But Not the 9 MPH Standard.</u>

The NPRM discusses two types of top-fittings protection, a performance standard requiring that the protection be required to withstand a rollover accident at a speed of 9 mph and AAR's design standard set forth in Appendix E, paragraph 10.2.1, of AAR's Specifications for Tank Cars. Heretofore, the performance standard has only been required for cars transporting toxic-by-inhalation hazardous materials.

AAR opposes requiring the performance standard for top-fittings protection. First, there would be a logical inconsistency in requiring that the performance standard be met for flammable liquids, but not other hazardous materials transported in pressure tank cars, e.g., flammable gases. If DOT wants to consider requiring the performance standard for hazardous materials other than TIH commodities, it should institute a separate rulemaking proceeding addressing other categories of hazardous materials, not just flammable liquids.

Second, the performance standard cannot be justified on a cost-benefit basis. The benefit is marginal. In fact, the RIA's analysis of the benefits of the performance standard is flawed.

PHMSA exaggerates the benefits of top fittings protective systems by assuming the systems will result in a significant reduction in the quantity lost in the event of a release, as well as assuming systems will reduce the likelihood of a release at all. While the protective system should reduce releases, the quantity released is unlikely to be affected to any significant degree by top fittings protection once there is a breach. There may be some reduction in quantity lost if in certain cases the damage is minimal enough that there is a very small opening for the release, but there is no basis for assuming that release quantities would be halved, as PHMSA assumes.[74]

Furthermore, AAR questions FRA's conclusions about the relative effectiveness of the performance standard. PHMSA observes that the performance standard is based on dynamic loads; standard top fittings protection is based on static loads. PHMSA then states that

> stresses imparted in the tank shell during the dynamic loads are three times those encountered during the static load. Therefore, DOT assumes the effectiveness of top fittings for the Option 1 tank car is three times that of the other tank car options.[75]

PHMSA's conclusion about the relative effectiveness of the proposed 9 mph standard is likely incorrect and overstates the relative effectiveness of the 9 mph standard. Unfortunately, there is not enough information in the docket to definitively evaluate PHMSA's modeling. To begin, it is unclear what is meant by "stresses imparted into the shell;" does this mean into the nozzle, and if so, how? Also, assuming that peak stress correlates well with effectiveness is incorrect. This assumption might arise from comparing the Sharma rollover tests to the rollover protection survival requirement. That would be inappropriate because the Sharma tests tipped the car and the motion was stopped by the fittings striking the ground, which differs from the regulatory assumption of a car beginning on the ground and continuously rolling.[76] In other words, the Sharma tests did not replicate the tank rollover

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[74] *See* "Calculating Effectiveness Rates, p. 11.

[75] Regulatory Impact Analysis, p. 118.

[76] *See* Robert Trent et al., "Survivability of Railroad Tank Car Top Fittings in Rollover Scenario Derailments," DOT/FRA/ORD-06/11 (December 14, 2005);

protection scenario the proposed regulation would require that top fitting protection survive and there is no evidence of a correlation between the Sharma test and the regulatory rollover scenario. Additionally, even if the three times estimate on stress magnitude were accurate, over what period of time is the stress magnitude maintained? The dynamic loading damage of a structure will be dependent on both the magnitude and duration of the load. The associated risk of dynamic loads cannot be evaluated without specifying both the load magnitude and duration. Furthermore, are any assumptions made about the motion of the lading, which differs in the tip-over case from the rolling car case?

There also is a significant question whether tank shells 7/16" or ½" thick can support top fittings complying with the performance standard. Indeed, PHMSA acknowledges this issue in discussing top fittings protection.[77]

PHMSA is not proposing top fittings protection on existing cars because of a concern that the costs outweigh the benefits.[78] AAR suggests that instead of requiring full top fittings protection, PHMSA require protection of the valves for retrofitted cars. The requirement for top fittings protection is set forth at 49 C.F.R. section 179.100-12. That section requires protection not only for the valve itself, but also the nozzle to tank connection, which requires significant modification and welding at the connection. A valve protection standard would only protect the valve and fitting and would not require significant modifications at the connection, thus addressing PHMSA's concern about the cost of top fittings protection.

Specifically, AAR suggests the retrofit standard have the following features for valve protection:

• Protective housing of cast, forged, or fabricated approved material must be bolted to fittings plate with not less than twenty 1/2" studs. The shearing value of the bolts attaching protective housing to the fitting plate must not exceed 70% of the shearing value of the bolts attaching the fittings plate to the fittings nozzle. Housing must have steel sidewalls not less than 1/2" in thickness that can be securely closed. Housing cover, if applied, must be at least 1/8" thick, hinged on one side, and equipped with a stop that prevents striking loading and unloading

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Robert Trent et al., "Survivability of Railroad Tank Car Top Fittings in Rollover Scenario Derailments—Phase 2," US DOT Report Number DOT/FRA/ORD-09/20 (October 2009).

[77] *See* 79 Fed. Reg. 45,056.

[78] 79 Fed. Reg. 45,059.

connections. The design of the protective housing and cover must not restrict the flow capacity of a pressure relief device below the minimum flow rating requirement as designed.

• Except when protected in accordance with 2.6.1.1 of AAR's Manual of Standards, the height profile of valve protection mounted on a tank nozzle must not exceed the dimensions in the AAR *Specifications for Tank Cars*, Appendix E.

• The service equipment must not project more than 1" about the fittings plate or be designed so that if the service equipment is sheared off of the fittings plate, a positive mechanical seal is maintained.

4. AAR Supports Requiring Thermal Protection and Pressure Relief Devices.

PHMSA proposes to require that tank cars transporting flammable liquids contain standard thermal protection systems, addressed in 49 C.F.R. § 179.18(a). These thermal protection systems enable a tank car to withstand a pool fire for 100 minutes and a torch fire for 30 minutes without release of product, except through the pressure release device.

Subsection 179.18(a) was promulgated with flammable gases in mind. Flammable liquids are very different from the perspective of trying to avoid thermal ruptures.

The RSI-AAR Project has modeled the survivability of different tank car configurations in a pool fire, using the "Analysis of Fire Effects on Tank Cars" (AFFTAC) model. AFFTAC modeling shows the use of thermal blankets on flammable liquid cars can result in a tank car containing flammable liquid withstanding a pool fire for 800 minutes or more without release of product, except through the pressure relief device.

Given the safety concern over flammable liquid accidents and its achievability as a standard, requiring survivability for 800 minutes in a pool fire should be required. PHMSA should require thermal blankets when flammable-liquid tank cars are built or retrofitted with jackets, given the significantly enhanced capability to withstand pool fires provided by thermal blankets. More specifically, PHMSA should require a thermal blanket with thermal conductivity no greater than 2.65 BTU per inch, per hour, per square foot, and per degree Fahrenheit at a temperature of 2000 F, ± 100F. Modeling has shown that a thermal blanket meeting this specification would provide at least 800 minutes protection in a pool fire. Blankets made of such materials are available; in fact, some are used on flammable-gas tank cars.

PHMSA should also require appropriately sized pressure relief devices for tank cars transporting flammable liquids. By "appropriate size," AAR means sizing the device in conjunction with the thermal protection on a tank car to allow the release of only enough of the commodity to protect against a thermal tear.

E. Shippers Should Not be Permitted to Avoid Compliance With More Stringent Tank Car Standards Through Reclassification As Combustible Liquids.

In the preamble, PHMSA states it intends to permit shippers to avoid complying with more stringent tank car standards by reclassifying flammable liquids as combustible liquids (this "rule does not cover unit trains of materials that are . . . reclassified as a combustible liquid").[79] As AAR stated in its ANPRM comments, it should be unacceptable to permit a shipper to downgrade the tank car required for its commodity by choosing to reclassify a flammable liquid as a combustible liquid. Reclassification should be prohibited for rail transportation.[80]

F. AAR Supports an Aggressive Retrofit/Phase-Out Schedule.

AAR urges PHMSA to adopt an aggressive phase-out schedule for cars that cannot meet retrofit requirements. The phase-out program must take into account factors such as manufacturing capacity, the demand for new tank cars, shop capacity for any retrofits that will be undertaken, and the number of DOT-111 cars that need to be phased out of flammable liquid service. As suggested in the joint filing by AAR and API, given PHMSA's focus on unit trains, it would make sense to make retrofitting tank cars in crude oil and ethanol service a priority since those commodities account for almost all the unit train service for flammable liquids. Input is needed from shippers and tank car manufacturers to determine the precise parameters of a phase-out program.

Having urged PHMSA to adopt an aggressive retrofit/phase-out schedule, AAR recognizes the uncertainty with respect to demand for rail transportation of flammable liquids and the capacity of tank car shops to manufacture and retrofit tank cars. PHMSA should explicitly recognize that its retrofit schedule might need to be adjusted and work with AAR's Tank Car Committee, which includes representatives from the railroads, shippers, and the tank car industry, as well as

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[79] 79 Fed. Reg. 45,059.

[80] The option to reclassify is set forth in 49 C.F.R. §§ 173.120(b)(2) and 173.150(f)(1). In addition, 49 C.F.R. § 172.102, Special Provision B1, would have to be amended to provide the correct reference for the new packaging requirements for flammable liquids in the 100 °F – 140 °F range.

representatives from DOT and Transport Canada, to monitor compliance with the rule and the demand for transportation of flammable liquids.

G. AAR Supports Using Legacy Cars in Canadian Oil Sands Service.

PHMSA states it expects some existing tank cars used for crude oil service to be transferred to Alberta oil sands crude oil service without retrofitting because that oil is a combustible, rather than a flammable, liquid.[81] AAR strongly supports the use of existing tank cars without retrofitting for undiluted oil sands crude oil.

Oil sands crude oil, or bitumen, can be transported in diluted or undiluted form. When bitumen is diluted with natural gas liquids for transportation purposes (dilbit), it often is a packing group I or II flammable liquid. Bitumen is diluted to facilitate transportation.

However, an option that AAR expects will be selected with increasing frequency is to transport undiluted bitumen in tank cars with heating coils. The heating coils can be used at destination to liquefy the bitumen for unloading. AAR understands that, as PHMSA states, undiluted bitumen is a combustible liquid or is not a regulated commodity at all and thus under the NPRM could be transported in unmodified tank cars.

PHMSA should ensure, in promulgating a final rule, that undiluted bitumen can be transported in tank cars without retrofitting. Undiluted bitumen does not present the flammability hazard of other crude oil, ethanol, or other flammable liquids. This would enable industry to concentrate on upgrading tank cars used to transport flammable liquids that present genuine flammability concerns.

VI. Other Issues

A. Flammable Gases Should Not Be Included In this Rule.

PHMSA asks if the HHFT restrictions should apply to flammable gases.[82] Expanding the speed restriction to additional commodities would further strain the railroad network. Furthermore, there is no basis in the rulemaking record for applying speed restrictions to these commodities.

PHMSA's HHFT concept is to apply speed restrictions where upgraded cars are not used. However, flammable gases are already transported in pressure cars so it seemingly would make no sense to apply the HHFT restrictions to flammable

[81] Regulatory Impact Analysis p. 81.
[82] 79 Fed. Reg. 45,040.

gases. Frankly, AAR does not understand PHMSA's question with respect to flammable gases.

B. <u>PHMSA Should Not Mandate More Track Inspections In this Rule.</u>

PHMSA seeks public comment on whether there should be changes to the track integrity regulations for HHFT routes. On January 24, 2014, FRA promulgated regulations prescribing specific requirements for rail inspection frequencies, rail flaw remedial actions, minimum qualifications for the operators of rail flaw detection equipment, and requirements for rail inspection records.[83] On May 26, 2014, the Rail Safety Advisory Committee (RSAC) accepted a new task to examine rail integrity. The task statement specifically directs RSAC to consider "whether additional track and rail inspection requirements should be required on high risk routes."[84]

PHMSA should defer to RSAC. The RSAC working group considering whether additional track integrity requirements are warranted consists of track experts from industry, labor, and the government. It is in the RSAC deliberations, not this proceeding, where any additional track integrity issues should be considered.

C. <u>Commodity Sampling and Testing Should Not be Required During Transportation</u>.

Proposed paragraph 173.41(a)(2) would require "[s]ampling at various points along the supply chain to understand the variability of the material during transportation." Surely PHMSA is not suggesting that during transportation tank cars be opened for sampling. Railroad facilities are not equipped for sampling, lacking, among other things, measures undertaken at fixed facilities to protect workers. If sampling is necessary, it should take place at origin and destination.

D. <u>The Term "High-Hazard Flammable Train" is Pejorative and Misleading.</u>

AAR urges PHMSA to use a less perjorative and misleading name than "high-hazard flammable trains" to describe trains transporting flammable liquids. Names matter. The phrase "high-hazard" stirs a feeling of apprehension. Using "high-hazard flammable train will make it more difficult to have a productive public dialogue about the transportation of flammable liquids. PHMSA does not use such terminology with respect to other hazardous materials, including toxic-by-

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[83] 79 Fed. Reg. 4,234 (Jan. 24, 2014).
[84] Task 14-02, https://rsac.fra.dot.gov/tasks.php.

inhalation hazardous materials. By using such a term here, PHMSA is implying that these commodities are more hazardous than any others.

The railroad industry has used the term "Key Train" for hazardous materials trains the industry has agreed should be subject to certain voluntary operating restrictions, including a 50 mph speed limit. Secretary Foxx used the term "Key Crude Oil Train" in his February 20, 2014, letter. Consequently, AAR suggests that PHMSA use the term "Key Flammable Liquid Train" in lieu of HHFT.

VII. Conclusion

It is important to the railroads, their business partners, and the general public that PHMSA move expeditiously to finalize tank car standards for the transportation of flammable liquids. In doing so, however, it should not impose counterproductive burdens on industry.

With respect to speed limits, it is important that PHMSA avoid restrictions that will substantially degrade the capacity and efficiency of the railroad network. Continuing the philosophy of Secretary Foxx to apply a 40 mph speed restriction in HTUAs would achieve PHMSA's safety objectives without drastically affecting the railroad network.

Were PHMSA to require ECP brakes, it would represent the second time in less than a decade that the federal government has chosen to impose a technology on the railroads where the costs far exceed the benefits. In the case of positive train control, DOT had no choice but to mandate PTC following the direction of Congress. Here, DOT would be doing so of its own volition. DOT should be concerned about the cumulative impact on the railroads of burdening the industry with regulatory mandates that cost billions without providing offsetting safety or business benefits. In any event, an ECP mandate cannot be justified, legally or as a matter of public policy.

Thank you for considering these comments.

Respectfully submitted,

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September 30, 2014

Attachment A

A Review of Analyses Supporting the Pipeline and Hazardous Materials Safety Administration HM-251 Notice of Proposed Rulemaking

Technical Report
September 29, 2014

Submitted by:

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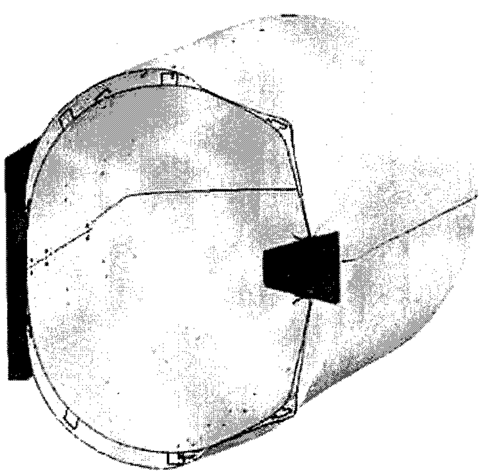
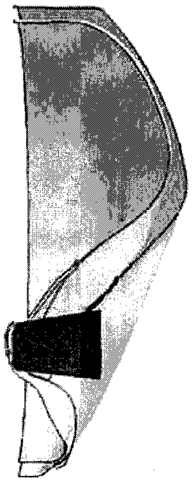




A Review of Analyses Supporting the Pipeline and Hazardous Materials Safety Administration HM-251 Notice of Proposed Rulemaking

The recent notice of proposed rulemaking (HM-251 NPRM) released by the Pipeline and Hazardous Materials Safety Administration's (PHMSA) included documentation of, or made reference to, analyses that were used to inform the rulemaking process. The objective of this document is to review and comment on these analyses in the areas of expertise by the author.

1 Review of Reference Document 1

One of the principal documents provided in the HM-251 NPRM was the July 2014 Letter Report, "Objective Evaluation of Risk Reduction from Tank Car Design & Operations Improvements" [1]. This is a significant document in that it describes the analytical methodology applied to assess the effectiveness of the tank design modifications, train speed operational restrictions, and various train braking systems.

The development of an analytical methodology to evaluate risk reduction from tank car design and rail operational improvements is complex. The authors developed an approach where they performed a series of derailment simulations to determine a distribution of impact forces in derailments. The simulations were limited to a set of twelve derailments performed at each of two different derailment speeds (30 and 40 mph). The calculated distribution of impact forces was compared to an assumed distribution of impactor threats and existing assessments of tank puncture resistance to calculate tank puncture probabilities. This model could then be adapted to assess proposed modifications to the tank car design and/or train operational conditions. The set of derailment simulations could be repeated with the modified model and the ratio of expected tank car releases between the original and modified simulations is used as the effectiveness of the proposed change.

The overall concept of approach in Reference 1 is appropriate, and it is consistent with the methodology of the Advanced Tank Car Collaborative Research Program (ATCCRP) TWP-11 project efforts. However, the key requirement of this approach is to capture enough of the actual derailment and impact physics to make the results realistic and representative of the real world derailment environment. In many of these areas, the methodologies applied in Reference 1 fall short. Below we address some of the significant issues identified that bring in to question the validity of the results. In general, we address issues in the order that they appear in Reference 1.

Item 1 - The Sharma study states that "The first fifty tank cars were modeled in three dimensions (3-D)," however, "the bolsters and couplers are constrained to move in the horizontal plane." This essentially constrains the derailment to 2-D motions and prevents 3-D motions such as tanks rolling over or lifting over other tanks. It also limits the derailment scenarios to be only on flat level ground and does not represent derailment conditions on slopes, elevated rail berms, running along, or crossing over, rivers or ravines, etc.

Item 2 – As a train car derails, it begins to slow down much more rapidly as the forward motion is resisted by the forces of the wheels, trucks, and other components plowing through or sliding over ballast, soil, or other ground conditions. These complex, and variable, mechanisms are commonly reproduced in derailment simulations using friction forces and that is the approach applied in Reference 1. In general, this is a reasonable approach to model these effects without introducing a much greater level of complexity to the analyses. However, the ground friction coefficient values of 0.27, 0.30, and 0.33 used in Reference 1 seem very low compared to other studies and the expected resistance levels of plowing through ballast or soft soil. Below are the similar frictional force level used in comparable derailment modeling efforts:

- Edward Toma developed a detailed two-dimensional train derailment model for his PH.D Thesis project [2]. In his model, he developed a velocity dependent ground friction model that had a coefficient of friction of 0.7 for low velocities and increasing with speed as shown in Figure 1. He noted that "A ground reaction force 0.3 times the local normal force is also unrealistically low." An example demonstrating the Toma derailment model performance for the 1979 Mississuaga, Ontario derailment is shown in Figure 2.
- The derailment simulations describe in Reference 3, which were performed in collaboration with the Volpe Transportation Systems Center, used a baseline frictional coefficient of 0.5 for the derailed cars and varied the value of the frictional coefficient in the range of 0.2-1.4. In a similar study they adjusted the range of frictional coefficients to 0.25-0.75 [4].
- Finite element based derailment simulations performed by Kirkpatrick, et. al., [5] used a post-derailment frictional coefficient of "approximately 1.0 for most analyses". A comparison of the calculated derailment behaviors with that model are shown in Figure 3.

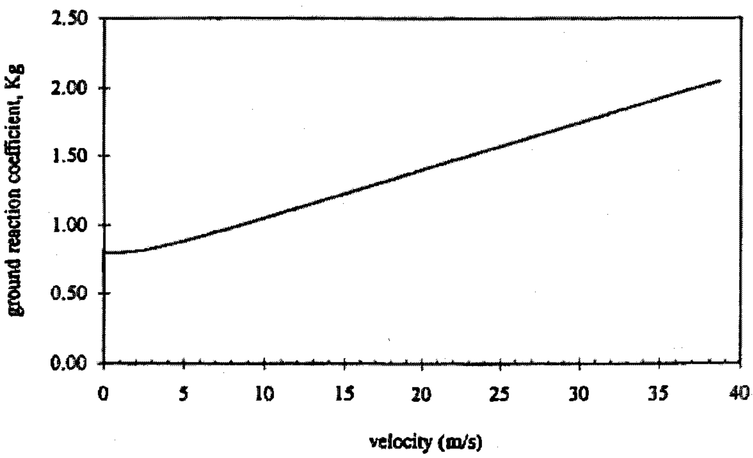
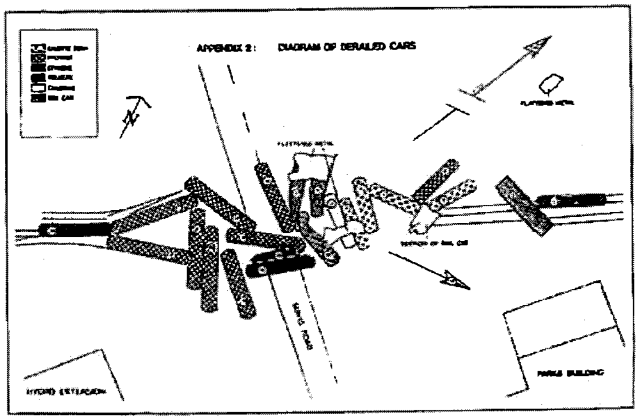
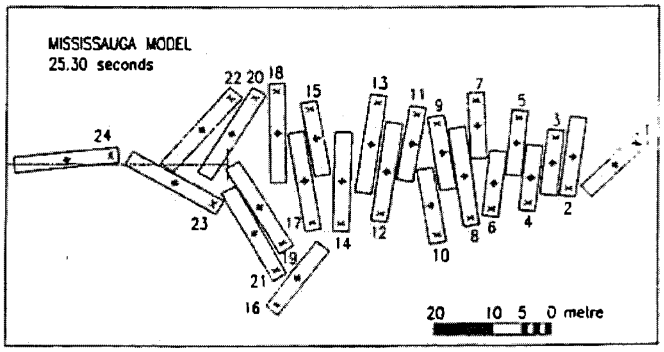


Figure 1. Ground reaction force model developed by Toma [1].



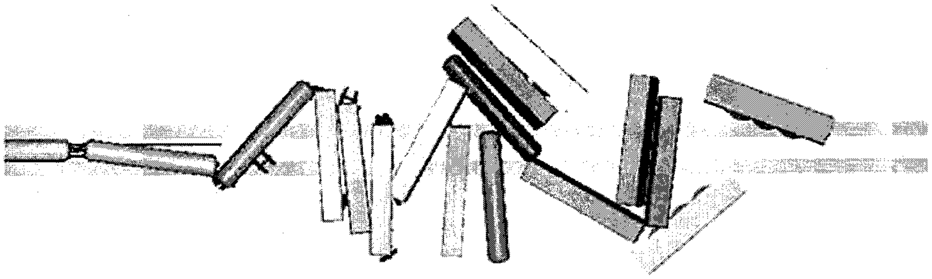
a) **Mississuaga derailment diagram**



b) **Calculated Mississuaga derailment outcome**

Figure 2. Derailment predictions using the model developed by Toma [1].

a) Aerial photograph of the Minot ND Derailment [6].



b) Calculated derailment response.

Figure 3. Derailment simulation using the model developed by Kirkpatrick, et al. [5].

The lower friction values used in Reference 1 may be an indication that the derailment simulations do not accurately capture the impact forces between cars or the interaction of the derailed cars with the remainder of cars in the train (the "blockage force" in Reference 7). If the model is not accurately modeling the magnitude of the blockage force, the subsequent evaluations of the operational improvements will not be accurate if based on the outcomes of such modeling.

Item 3 – The tank cars used in the derailment simulations were DOT-111 tank cars. The weight of the lading was included in the analyses by increasing the density of the commodity tanks to include the lading weight in the tank shell. However, the additional effect that the compressibility of the lading has on the tank deformations and impact forces was not included in the model. This can be seen in the damage observed in some of the tank cars that include large dents that would not be possible without rupturing the tank to relieve the pressure build up in the lading.

We believe that this approximation could have a significant influence on the calculated impact forces. In particular, the approximation could significantly under predict the impact forces for many impact conditions. Consider the comparison of two analyses with identical impact conditions shown in Figure 4 [9]. The identical tanks were impacted with a 6x6 inch impactor (286,000 lbs) at a speed of 16.2 mph corresponding to an initial 2.5 MJ impact energy from Reference. The tank in both analyses is a DOT 111 tank car design constructed with a 7/16-inch-thick A516-70 steel tank shell. The only difference is that one of the tanks includes the effect of a 3% outage with the internal pressure calculated by a control volume that calculates the compression of the gas in the outage as the tank is dented and approaches a shell full condition. In the second analyses the tank remains unpressurized as if the tank were empty (although the weight of the lading was still smeared into the tank shell to maintain the inertial effects). This second analyses corresponds to the modeling approach used for the tanks in Reference 1.

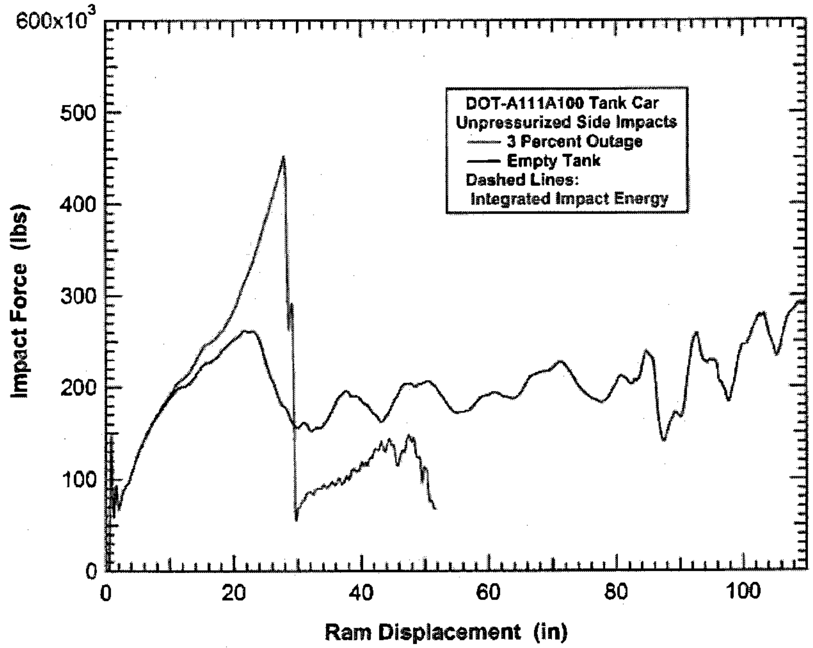


Figure 4. Force-deflection curves for different tank outage volumes.

In the first analysis (red curve), the impact forces begin to rise rapidly after approximately 20 inches of ram displacement to the point where the tank is punctured at a force of approximately 450 kips. With a larger impactor that did not puncture the tank, the forces would have continued to rise rapidly to significantly higher levels. The second impact response of the "empty tank", modeled without the lading compressibility effects, deforms the tank in excess of 100 inches without the impact force ever exceeding 300 kips (blue curve). Thus, not including the lading compressibility effect could significantly bias the analysis of the force distribution in Reference 1 toward a lower impact force distribution.

A consequence of this bias in the analysis toward smaller impactor forces is that the assumed impactor size distribution would also need be skewed toward smaller impactors. Without assuming that small impactors are much more common in the derailment impacts, the predicted number of tank punctures in this methodology, as shown in the Dynamic Model Validation section of the report, would be lower and not in agreement with the limited set of derailments included in the comparison. Having a model that is biased toward small impactors could influence the following evaluation of the tank design modifications since the impact and failure behaviors of large and small impactors are not identical.

Item 4 – The impact force histogram in Reference 1 was evaluated based on the derailment simulations with a unit train consisting entirely of the baseline DOT-111 tank car design. As a result, the force histogram is accurate only for that design of tank car. If the car design was modified to include a thicker tank shell, the tanks would as a result have a higher structural stiffness. A consequence of the higher stiffness would be an increase in the impact forces for a given impact condition. Similarly, the stiffness of other impacting car types was not considered for a revenue train with a mix of car types.

The change to the force histogram was not included in the assessment of the effectiveness of improved tank car designs. By considering only the improved puncture resistance, without evaluating the corresponding increase in impact forces, Reference 1 would overestimate the effectiveness of the design change in preventing releases.

Item 5 – The analyses in Reference 1 only considered derailments of a string of 80 cars. By considering only longer train section, it could bias the result toward a scenario where changes to the train braking system will have the greatest influence. With a longer string of cars and conventional air-brake systems there will be a longer propagation time for the brakes to be fully applied. In addition, the effects of the derailment blockage forces on the deceleration will be smallest (while still significant) for a longer string of cars since the residual mass of the cars on the rail will be larger. Thus an analysis of the Electrically Controlled Pneumatic (ECP) brake improvement will be overstated by this analysis since it did not include a real world distribution of derailment points with the trains.

Item 6 – The prediction of the number of cars punctured in the derailments will be controlled by three factors: 1) the impact force distribution, 2) the tank puncture resistance capability, and 3) the impactor size distribution. The first two of these can be addressed by modeling. However the third can be obtained only by 2 methods. The first would be an extensive forensic investigation of a large number of real world derailments where the impact conditions are reconstructed and an attempt to characterize each of the impactors and their characteristic size. This would be a very time consuming and expensive effort. The second is to assume a distribution and modify it until it results in the correct number of punctures in the analysis. This is the approach used in Reference 1. They state that "there is no hard basis for the specific sizes assumed herein."

I believe that their assumed impactor size distribution is skewed toward smaller impactors. I think this is a result of the lower impact force levels obtained from neglecting the lading compressibility effects in the derailment simulations (Item 3). The fact that the punctures are dominated by these smaller impactors at lower force levels has the potential to significantly influence the prediction of the effectiveness of tank car design improvements.

The authors of Reference 1, when discussing the assumed impactor distribution, also state that "these assumptions are consistent with engineering expectations, and further more, appear to be consistent with validation against real life observations." The engineering expectations of this reviewer would not include approximately half of all impactors having a size of seven inches or less and fewer than 10% of impactors greater than 13 inches. I would have expected that tank to tank impacts in unit trains would be common and the effective size of a tank shell or tank head impactor would be much greater than 13 inches. In addition, the match against the limited set of real world derailments provided does not validate the assumed size distribution. It is possible that significantly different impactor size distributions might also have been consistent with this limited "validation". Unless there is a reason to think that this is close to the true size distribution, assessments of the effectiveness of other risk reduction options could be in error.

Item 7 – The analyses show a significant variance in number of cars derailed at each speed considering the variation of parameters used in the analyses. For example, the 40 MPH derailment simulations indicate that a range of between 16 and 35 cars were derailed in the twelve analyses performed (Figure 8 in Reference 1). However, the only parameters that can lead to this level of variation are:

- "Three values of coefficient of friction between tanks and ground, representing multiple terrain conditions: 0.27, 0.30, and 0.33." Note that this is a 10 percent variation above and below the mean value.
- "Two values of lateral force to initiate derailment: 50 and 70 kips."
- "Two values of track stiffness, representing variations in track quality: 30 and 40 kips/in."

Although the Federal Railroad Administration (FRA) data in Figure 8 of Reference 1 shows a scatter of derailed cars at 40 mph to vary from 1 to 43 cars, this variability is understandable given the wide range of derailment scenarios possible. A single car may derail from a broken wheel or axle but remain coupled to the cars ahead and behind the derailment point so that it is the only car that derails. Alternatively the other factors such as terrain or grade, the point in the train where the derailment initiates, ground conditions, etc. could result in significantly more or less cars being derailed at a given derailment speed.

From the parameter variation described in Reference 1 (listed above) we believed that the track interaction was the most significant factor that would influence the variability seen in number of cars derailed. To better understand the derailment mechanics, we attempted to identify the response with only 16 cars derailed and believe it is the top row center case shown in Figure 4 of Reference 1. We have reproduced the final state for that scenario in Figure 5 adding numbers counting the cars we believe to be derailed.

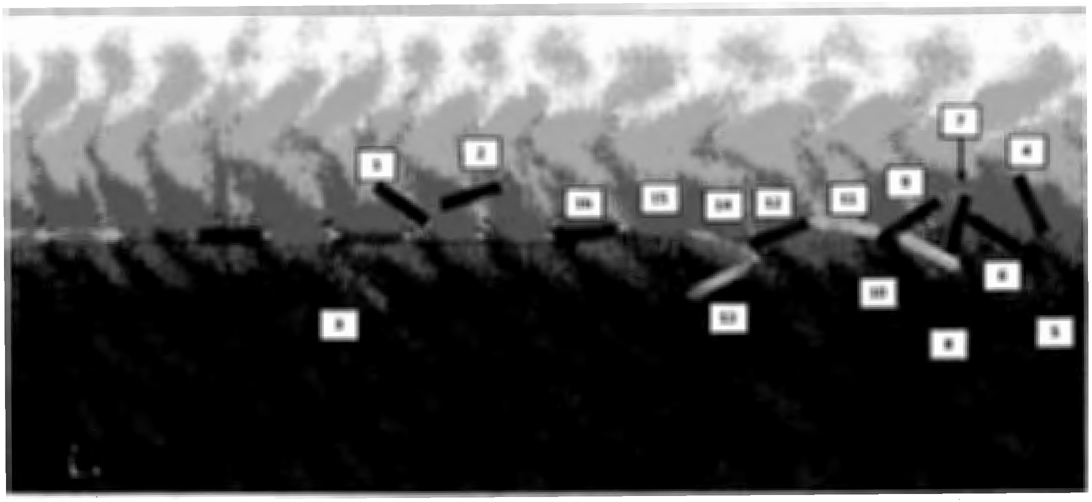


Figure 5. Derailment simulation for Scenario 2 at 40 mph from Reference 1.

Obviously the simulation was performed with the train moving from left to right in Figure 5. However the final state indicates that Cars 1, 2, and 3 have derailed and came to rest at a position that is behind a point where other cars are still on the rail. This indicates that the simulations do not include any feature for a mechanism such as a broken rail where every car passing beyond that point is automatically derailed. In these simulations, cars can be pushed out of the way of the remaining cars without damaging the track so that subsequent cars are only derailed when their lateral forces exceed the "track quality" strength values.

These mechanisms of broken rails or track torn up by the initial derailing cars are common and important mechanisms that can influence the derailment behavior and number of cars derailed. Broken-rail derailments are among the highest in severity as measured by the number of cars derailed, and therefore a bias created by leaving this mechanism out could underestimate the number of cars derailing. Such a bias could make it look like the model validates but actually mask a bias somewhere in the other direction (such as the track strength and ground friction effects). The interaction of these biases leaving us uncertain which aspects of these predictions are close enough to rely on.

Item 8 – An important aspect of a model used to support important regulatory changes such as those proposed in the HM-251 NPRM is that the model is sufficiently validated to provide confidence in the results. The efforts to validate the analysis methodologies are provided in Section 4 of Reference 1. There are two components of the model that are discussed in this section: 1) the dynamic derailment model, and 2) the analyses of the number of punctures.

The validation of the derailment dynamics model is primarily based on comparing the number of cars derailed in the simulation to the data from the FRA-RAIRS database and the result that "the derailment simulations of number of cars derailed are consistent with the spread seen in actual derailment data." This observation about the consistent results is subjective. The model certainly does not reproduce the character of the significant number of derailments up to 50 mph that include only 1-5 cars derailed. Even if the number of cars derailed were to match the FRA-RAIRS data distribution, it would not necessarily be sufficient evidence to validate the model. This is particularly true in light of other deficiencies observed in the derailment kinematics such as described in Item 6.

Similarly the comparison of the number of cars derailed to a limited set of hazardous material derailments (Table 2 and Figure 9) is not helpful for validation. First, the simulations do not correspond to the same range of initiating events and number of cars involved in those accidents. More importantly, the set of cases selected for the comparison do not represent the full range and distribution of derailment mechanisms observed in the real world.

The validation of the puncture estimates is obtained by comparing the mode estimates to the 12 hazardous material derailments included in Table 2. There are multiple problems with this validation. First, it is not really a validation since the results are completely controlled by the assumed impactor size distribution for which they have no physical basis (Item 6). At best it is a check on assumptions rather than a validation of modeling results. Secondly, it is a validation of a match to 12 specific derailments which are not representative of the real world distribution of accidents and releases. Finally, not all of the accidents selected were unit trains and not all of the tank punctures in these derailments were unpressurized DOT-111 tank cars. Thus the validation is comparing to data from derailment scenarios that are different from the parameters used in the model predictions.

Item 9 – The couplers and draft gear provides the interaction between cars in the initial portion of the derailment behavior and the failure of the coupled connections is required to set up any potential side impact collisions in the subsequent derailment pile-up. In real world derailments, the coupled connections can fail from multiple mechanisms including opening of the coupler connections, failure of a coupler knuckle, failure of a coupler shaft, and ultimately failure of the connection between the draft gear and the tank car sill. Capturing the behavior of the draft gear and the failure of the coupled connections under various loading scenarios is significant for reproducing correct derailment mechanics in a model.

Reference 1 states that: "The cars were modeled with deformable TC128 material, and connected with discrete draft gear and coupler models. The couplers models allowed a 7 degree swing in each direction, with the knuckles modeled to resist rotation and fail when the rotation exceeds 13.5 degrees." No information was provided to determine the corresponding forces in the coupled connections required to exceed the 13.5 degree failure criterion. In addition, there is no information on the connections of the draft gear to the sill or the energy absorbing characteristics in the draft gear. As a result, it is impossible to evaluate these characteristics of the model with the information provided.

Item 10 – The interaction of the trucks, wheels, and rails of the tank car can be significant for certain types of derailment behaviors. In Reference 1, the trucks and rails are not explicitly modeled. Rather, their effect is included by applying a constraint condition at each bolster location until a derailment criterion is met. It is believed that this derailment criterion is controlled by "Two values of track stiffness, representing variations in track quality: 30 and 40 kips/in."

We believe that the approach being applied for these track interaction effects is insufficient to model many types of derailment behaviors. However, there is insufficient information being provided to properly evaluate the model.

Item 11 – The letter report provided as Reference 1 does not provide a complete summary of the work performed in support of the NPRM. Many of the previous items listed in this document describe areas of the modeling methodology where insufficient information is provided to fully understand the methodologies applied (e.g. wheel-rail interactions, breaking force application, etc.) Similarly, the results of analyses performed in support of the HM-251 are not fully documented. For example, the technical supplement on calculating the effectiveness of alternative tank car options references analyses performed for 50 mph derailments (Table 3 of Reference 10). Including these higher speed analyses in Reference 1 would have provided more information that could be used in the evaluations of the model results. Similarly, the conclusions on the effectiveness of ECP brakes were made based on a preliminary set of 6 analyses. However, the specific conditions of those six analyses were not presented. As a result, we are not able to evaluate if these six analyses are biased toward scenarios that might have a less severe outcome (e.g. all analyses using the higher strength track condition or lower derailment initiating force).

2 Review of Reference Document 2

A second principal documents provided in the PHMSA HM-251 NPRM was the Draft Regulatory Impact Analysis, "Hazardous Materials: Enhanced Tank Car Standards and Operational Controls for High-Hazard Flammable Trains; Notice of Proposed Rulemaking" [11]. A full evaluation of this reference was beyond the scope of the effort described in this document. However, one specific observation is made here.

Item 12 – Table TC 31 lists the effectiveness of newly constructed tank car options relative to the baseline DOT-111 tank car. One notable conclusion is that the Option 1 tank car design has a top fittings configuration that is three times more effective than the baseline. The rollover protection for the Option 1 tank car is based on protecting against dynamic load conditions described in 179.102-3. Below the table, they state that: "Modeling indicates the stresses imparted in the tank shell during the dynamic loads are three times those encountered during the static load. Therefore, DOT assumes the effectiveness of top fittings for the Option 1 tank car is three times that of the other tank car options."

There are several issue related to these claims. These include:

- There is no description of (or reference provided for) the analyses used to evaluate either the static baseline analysis or the dynamic loading that produced three times higher stresses in the tank shell. As a result we are not able to evaluate the analyses or confirm the stresses are three times as large.
- The higher stresses were indicated to be in the tank shell. However, if that is not the point at which failure initiates, the higher stresses may not be a concern.
- There is no basis for assuming that a threefold increase in stress levels would correspond to a three times increase in effectiveness. This would only apply for a linear system and the tank car damage and failure behaviors are very nonlinear.
- A three times peak dynamic stress level is not equivalent to a three times static stress level. The magnitude has to be evaluated using the duration at which the stress is above a threshold level compared to the characteristic time required for the associated damage mechanism. For example a dynamic stress magnitude that is three times that of the static stress, but only applied for 1 millisecond, would probably be a less effective evaluation of the top fittings protection than the lower baseline static load level.

Item 13 – The proposed action on braking is based on simulations of braking performance: "The simulations were performed using the Train Energy & Dynamics Simulator (TEDS) program, developed by Sharma & Associates to study the dynamics and energy levels under a variety of operating conditions." The analyses use the assumptions, "Each train includes three locomotives at 415,000 lbs., 100 cars at 263,000 lbs., train length 6,164 ft." Again, there are issues with this approach. These include:

- The TEDS simulations of braking performance do not include the impact forces between cars or the interaction of the derailed cars with the remainder of cars in the train (the "blockage force" in Reference 7). This blockage force has been shown to be a significant factor in the deceleration of the train and in some derailments is greater than the total emergency braking force of the cars behind the derailment point. Neglecting this effect will significantly overestimate the effectiveness of ECP braking.
- The analyses of 100 car trains assume that the derailments all initiate at the front of a long train (not seen in actual derailment data). This scenario is also the case that will produce the largest difference in the different braking systems since it will have the longest propagation times (delay times) for the brake signal to reach each car. Thus the assumption will overstate the effectiveness that would be seen in real world derailment conditions.

3 References

1. Sharma & Associates, Inc., "Objective Evaluation of Risk Reduction from Tank Car Design & Operations Improvements," Letter Report, July 2014.
2. Toma, E. E., "A Computer Model of a Train Derailment", Ph.D. Thesis, M.E. Dept., Queens University, Ontario, Canada, October 1998.
3. C.R. Paetsch, A.B. Perlman, and D.Y. Jeong, "Dynamic Simulation of Train Derailments", Proceedings of IMECE2006, 2006 ASME International Mechanical Engineering Congress and Exposition, Paper Number IMECE2006-14607.
4. D.Y. Jeong, M.L. Lyons, O. Orringer, A.B. Perlman, "EQUATIONS OF MOTION FOR TRAIN DERAILMENT DYNAMICS," Proceedings of the 2007 ASME Rail Transportation Division Fall Technical Conference, Paper Number RTDF2007-46009.
5. S.W. Kirkpatrick, B.D. Peterson, and R.A. MacNeill, "Finite Element Analysis of Train Derailments," ICrash2006. Proceedings of the International Crashworthiness Conference, July 4-7, 2006, Athens, Greece.
6. Derailment of Canadian Pacific Railway Freight Train 292-16 and Subsequent Release of Anhydrous Ammonia Near Minot, North Dakota, January 18, 2002, NTSB Railroad Accident Report No. NTSB/RAR-04/01, March 2004.
7. Joseph Brosseau, "Analysis and Modeling of Benefits of Alternative Braking Systems in Tank Car Derailments," Transportation Technology Center, Inc., Draft technical Report, September 2014.
8. S.W. Kirkpatrick, "Detailed Puncture Analyses of Various Tank Car Designs," ARA Final Technical Report, Prepared for the Next Generation Railroad Tank Car (NGRTC) Project, January, 2009.
9. S.W. Kirkpatrick, "Analyses of Outage Volume Effects on Puncture Energy for Unpressurized DOT-111A100W Tank Cars," ARA Technical note, January, 2010.
10. Pipeline and Hazardous Materials Safety Administration (PHMSA), "Calculating Effectiveness Rates of Tank Car Options," HM-251 NPRM Technical Supplement, 2014.
11. Pipeline and Hazardous Materials Safety Administration (PHMSA), "Hazardous Materials: Enhanced Tank Car Standards and Operational Controls for High-Hazard Flammable Trains; Notice of Proposed Rulemaking," Docket No. PHMSA-2012-0082 (HM-251), Draft Regulatory Impact Analysis, 2014.

Attachment B

AAR RESEARCH

ANALYSIS AND MODELING OF BENEFITS OF ALTERNATIVE BRAKING SYSTEMS IN TANK CAR DERAILMENTS

R-1007

SEPTEMBER 2014

Work performed by:

TTCI

Transportation Technology Center, Inc.

A SUBSIDIARY OF THE ASSOCIATION OF AMERICAN RAILROADS

Analysis and Modeling of Benefits of Alternative Braking Systems in Tank Car Derailments

R-1007

by

JOSEPH BROSSEAU

Transportation Technology Center, Inc.,
a subsidiary of the Association of American Railroads
Pueblo, Colorado USA
September 2014

1. Report No. R-1007	2. Report Date September 2014	3. Period Covered
4. Analysis and Modeling of Benefits of Alternative Braking Systems in Tank Car Derailments		
5. Joseph Brosseau		
6. Performing Organization Name and Address Transportation Technology Center, Inc. a subsidiary of the Association of American Railroads P. O. Box 11130 Pueblo, Colorado 81001		7. Type of Report Research Report 8. Contract or Grant No.
9. Sponsoring Agency Name and Address Association of American Railroads 50 F Street NW Washington, DC 20001		10. Number of Pages 20 11. Number of References
12. Supplementary Notes		

13. Abstract

The Pipeline and Hazardous Materials Safety Administration (PHMSA) has issued a Notice of Proposed Rulemaking (NPRM) titled "Hazardous Materials: Enhanced Tank Car Standards and Operational Controls for High-Hazard Flammable Trains" [Docket No. PHMSA-2012-0082 (HM-251)], in which they have asked for comments by September 30, 2014. One component of the proposed rulemaking (section V.E.b) addresses Alternative Brake Signal Propagation Systems, including Electronically Controlled Pneumatic (ECP) brake systems. In this section, the NPRM describes simulations conducted by the Federal Railroad Administration (FRA) and concludes "that ECP brakes would reduce accident severity by 36 percent compared to conventional brakes with end-of-train (EOT) devices, and by 18 percent compared to locomotives with distributed power (DP) or another EOT device." Based on this conclusion, PHMSA proposes several requirements associated with ECP brake systems. The NPRM requests comments on the PHMSA estimates for reduced accident severity and to what extent simulation models other than that used by FRA validate these estimates. This paper addresses this request for comment.

14. Subject Terms Electronically controlled pneumatic (ECP) brake systems	15. Availability Statement Transportation Technology Center, Inc., a subsidiary of the Association of American Railroads P. O. Box 79780 Baltimore, Maryland 21279-0780
Note: To help us continue to improve the quality and value of AAR/TTCI reports, send comments or suggestions to peggy_herman@ttci.aar.com.	

EXECUTIVE SUMMARY

The Pipeline and Hazardous Materials Safety Administration (PHMSA) has issued a Notice of Proposed Rulemaking (NPRM) titled "Hazardous Materials: Enhanced Tank Car Standards and Operational Controls for High-Hazard Flammable Trains" [Docket No. PHMSA-2012-0082 (HM-251)], in which it has asked for comments by September 30, 2014. One component of the proposed rulemaking (section V.E.b) addresses Alternative Brake Signal Propagation Systems, including Electronically-controlled Pneumatic (ECP) brake systems. In this section, the NPRM describes simulations conducted by the Federal Railroad Administration (FRA) and concludes "that ECP brakes would reduce accident severity by 36 percent compared to conventional brakes with end-of-train (EOT) devices, and by 18 percent compared to locomotives with distributed power (DP) or another EOT device." Based on this conclusion, PHMSA proposes several requirements associated with ECP brake systems. The NPRM requests comments on the PHMSA estimates for reduced accident severity and to what extent simulation models other than that used by FRA validate these estimates. This paper addresses this request for comment.

The simulation results and analysis presented in the NPRM and supporting documents indicate that the 36 percent reduction in accident severity estimate is based on the reduction in the kinetic energy of the tank cars trailing the point of derailment. A modeling and analysis effort was conducted by Association of American Railroads (AAR) and Transportation Technology Center, Inc. (TTCI) with independent review by Applied Research Associates, Inc., (ARA) to verify the statements in the NPRM. This effort considered a number of factors that do not appear to be considered in the analysis supporting the PHMSA estimate of reduced accident severity, including most notably, the magnitude of the force applied to the cars trailing the point of derailment caused by the derailment blockage and the potential for a derailment to occur anywhere within the train. The effort included analysis of actual derailments to develop and verify the methodology used and a parametric analysis to cover a broad range of operating conditions, derailment locations within the train, and braking systems.

The study estimates that ECP brakes will reduce the energy dissipated in a derailment by an average of 13.3 percent and will reduce the number of cars in a derailment by less than two cars, on average, compared to other braking systems. The conclusion of this effort is that the PHMSA estimate that ECP brakes would reduce accident severity by 36 percent is overstated and misrepresents the potential benefit of implementing ECP brakes in reducing the severity of accidents involving what PHMSA is calling "high-hazard flammable trains."

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1.0 INTRODUCTION AND SUMMARY

The Pipeline and Hazardous Materials Safety Administration (PHMSA) has issued a Notice of Proposed Rulemaking (NPRM) titled "Hazardous Materials: Enhanced Tank Car Standards and Operational Controls for High-Hazard Flammable Trains" [Docket No. PHMSA-2012-0082 (HM-251)], in which it has asked for comments by September 30, 2014. One component of the proposed rulemaking (section V.E.b) addresses Alternative Brake Signal Propagation Systems, including Electronically-Controlled Pneumatic (ECP) brake systems. In this section, the NPRM describes simulations conducted by the Federal Railroad Administration (FRA) and concludes "that ECP brakes would reduce accident severity by 36 percent compared to conventional brakes with end-of-train (EOT) devices, and by 18 percent compared to locomotives with distributed power (DP) or another EOT device."[1] Based on this conclusion, PHMSA proposes several requirements associated with ECP brake systems. The NPRM requests comments on the PHMSA estimates for reduced accident severity and to what extent simulation models other than that used by FRA validate these estimates. This paper addresses this request for comment.

The simulation results and analysis presented in the NPRM and supporting documents indicate that the 36 percent reduction in accident severity estimate is based on the reduction in the kinetic energy of the tank cars trailing the point of derailment. The estimated reduction in the kinetic energy is based on a very limited set of simulations and looks only at derailments that occur at the head end of a train. The NPRM supporting documentation states that, "given that this is based on a limited simulation set, the results could be optimistic, and should be taken with a grain of salt…it is anticipated that the percent improvement due to ECP would likely drop to about 25%..."[2] There is no indication of how the 25-percent estimate was derived, but the wide range of reported estimates for potential reduced accident severity with ECP brakes suggests a more complete analysis with validation against actual events is necessary to understand the actual potential benefit.

Based on this, a separate modeling and analysis effort was conducted by Association of American Railroads (AAR) and Transportation Technology Center, Inc., (TTCI) with independent review by Applied Research Associates, Inc. (ARA). This effort considered a number of factors that do not appear to be considered in the analysis supporting the PHMSA estimate of reduced accident severity, including:

- The magnitude of the force applied to the cars trailing the point of derailment. There is a considerable amount of force that works to decelerate the mass of the cars trailing the point of derailment due to the blockage resulting from the derailment itself, which significantly limits the potential contribution from any braking system.

[1] Federal Register. Pipeline and Hazardous Materials Safety Administration (PHMSA) Notice of Proposed Rulemaking (NPRM), section V.E.b, item (3), page 45051, Department of Transportation, Federal Register/Vol. 79, No. 148, Friday, August 1, 2014/Proposed Rules.
[2] "Objective Evaluation of Risk Reduction from Tank Car Design & Operations Improvements," Section 5, page 13, submitted by Sharma & Associates to Federal Railroad Administration July 2014.

- The potential for a derailment to occur anywhere within the train. The maximum potential benefit of a given braking system is when the derailment occurs at the head end of the train; therefore, to accurately assess the potential benefit of alternate braking systems, derailments that occur at various points in the train must be considered.

- The variability in the response of a train to various types of derailments. There is a wide variety of types of derailments and derailment causes and while certain types of derailments will result in a pile up of cars at the point of derailment, others will have far less dramatic results. The effect of an alternate braking system in these other derailments is more difficult to quantify, but should be recognized in an assessment of the potential reduction in accident severity.

The AAR/TTCI study made use of the Train Operations and Energy Simulator (TOES™) model that has been in use for nearly 30 years, has been validated many times over, and is considered an industry standard for train dynamics modeling.[3,4,5] The study investigated several of the derailments cited in the NPRM, as well as other similar types of derailments, to develop and validate a methodology for estimating the potential reduction in accident severity. The methodology uses output from TOES to model the contribution of the braking system. The additional force acting to decelerate the train from the derailment blockage was then added to the TOES result to estimate the total energy dissipated in the derailment and number of cars reaching the point of derailment. Event recorder data from remote DP locomotives involved in derailments (such as the Aliceville, AL, derailment cited in the NPRM) provided accurate rear-of-train speed profiles to determine the magnitude of the blockage force. The speed profiles and stopping distances modeled compare well to the data from these actual derailments.

With the derailment blockage collision force included in the analysis, simulations of the derailments were conducted with ECP brakes as well as conventional braking systems. For the example of the Aliceville, AL, derailment, ECP brakes would have reduced the energy in the derailment by 12 percent compared to the conventional braking with DP that was actually in place. The number of cars reaching the point of derailment would have been reduced by 1.5 cars.

[3] Klauser, Peter, David Mattoon, Som P. Singh, and O. Ahmad. August 1986. "The Train Energy and Operations Simulator (TOES): A New Approach to Train Action Simulation," AAR Report No. WP-124, Association of American Railroads, Washington, D.C.

[4] Andersen, David R., David W. Mattoon, and Som P. Singh. November 1991. "Revenue Service Validation of Train Operations and Energy Simulator (TOES) – Version 1.5 Part I: Conventional Unit Coal Train," AAR Report R-799/SD-036, Association of American Railroads, Technical Center, Chicago, IL

[5] Andersen, David R., David W. Mattoon, and Som P. Singh. December 1992. "Revenue Service Validation of Train Operations and Energy Simulator (TOES) – Version 2.0 Part II: Intermodal Train," AAR Report R-822/SD-042, Association of American Railroads, Technical Center, Chicago, IL.

Based on the methodology developed, an analysis of 420 simulations was conducted that covered a variety of parameters, including:

- Train speed at derailment – speeds of 30, 35, 40, 45, and 50 mph were included.
- Point of derailment within the train – derailments occurring at the head-end, 1/4-way through the train, 1/2-way through the train, and 3/4-way through the train were included.
- Track grade – grades of 1% uphill, 1% downhill, and flat (0%) were included.
- Brake system – conventional (head-end), conventional with end-of-train device (ETD), rear-end DP, mid-train DP with ETD, DP at 2/3 with ETD, ECP, and ECP with rear-end wired DP were included.

The result of the modeling and analysis effort can be seen in Table 1, which shows the average percent reduction in energy dissipated by the derailment and the average reduction in number of cars entering the derailment for ECP brakes as compared to other braking systems.

Table 1. Average Percent Reduction in Energy Dissipated in Derailment and Number of Cars Reaching Point of Derailment

Performance of ECP Brake System Compared To:	Average Percent Reduction in Energy Dissipated in Derailment	Average Reduction in Number of Cars Reaching Point of Derailment
Conventional Brakes (Head-end)	13.3%	1.6
Conventional Brakes with ETD	11.6%	1.3
Rear-end DP	12.8%	1.5
Mid-train DP	10.5%	1.2
DP at 2/3	10.8%	1.2

As Table 1 indicates, the study estimates that ECP brakes will reduce the number of cars in a derailment by less than two cars, on average, compared to other braking systems. This analysis investigates only derailments that result in a significant blockage at the point of derailment, and is therefore likely an overestimate of the overall potential benefit, considering other types of derailments. The conclusion of this effort is that the PHMSA estimate that ECP brakes would reduce accident severity by 36 percent is overstated and misrepresents the potential benefit of implementing ECP brakes in reducing the severity of accidents involving high-hazard flammable trains.

2.0 ANALYSIS OF ACTUAL DERAILMENTS AND VALIDATION OF METHODOLOGY

The objective of the analysis of actual derailments was twofold:

1. Estimate and account for the derailment blockage force and validate against actual derailment data.

2. Investigate the potential benefits of alternative braking systems using actual derailment data.

As discussed previously, the estimation and validation of the derailment blockage force was performed by matching the simulated speed profile of the rear of the train to event recorder data from actual derailments. One of the derailments cited in the NPRM, the Aliceville, AL, derailment, had remote DP unit event recorder data readily available. This derailment occurred near the head end of the train (first car). To provide further validation, two other derailments that resulted in a significant derailment blockage, but occurred elsewhere within the train, were analyzed:

- Brainerd, MN; 7/10/2011; 27 mph; Loaded unit coal train, 121 loads/0 empties, 20 cars derailed (car numbers 66-85)
- Wagner, MT; 2/13/2013; 37 mph; Loaded unit grain train, 104 loads/0 empties, 10 cars derailed (car numbers 88-97)

Event recorder data from the remote DP locomotive in the Aliceville, AL, derailment shows the train was traveling 39 mph at the time the emergency brake application was initiated and the rear end of the train stopped in 36 seconds. The TOES simulation was run with an emergency brake application occurring at the head end of the train followed immediately by an emergency brake application from the rear end of the train after being communicated to the remote DP locomotive via the DP radio link. The result of this simulation showed the rear end of the train coming to a stop in 57 seconds. Following the approach described previously, a derailment blockage force of 500,000 pounds was added to the result of the TOES simulation, and the computed time for the rear end to come to a stop was 36 seconds, matching the event recorder data. Figure 1 shows the speed versus time profile for each of these cases.

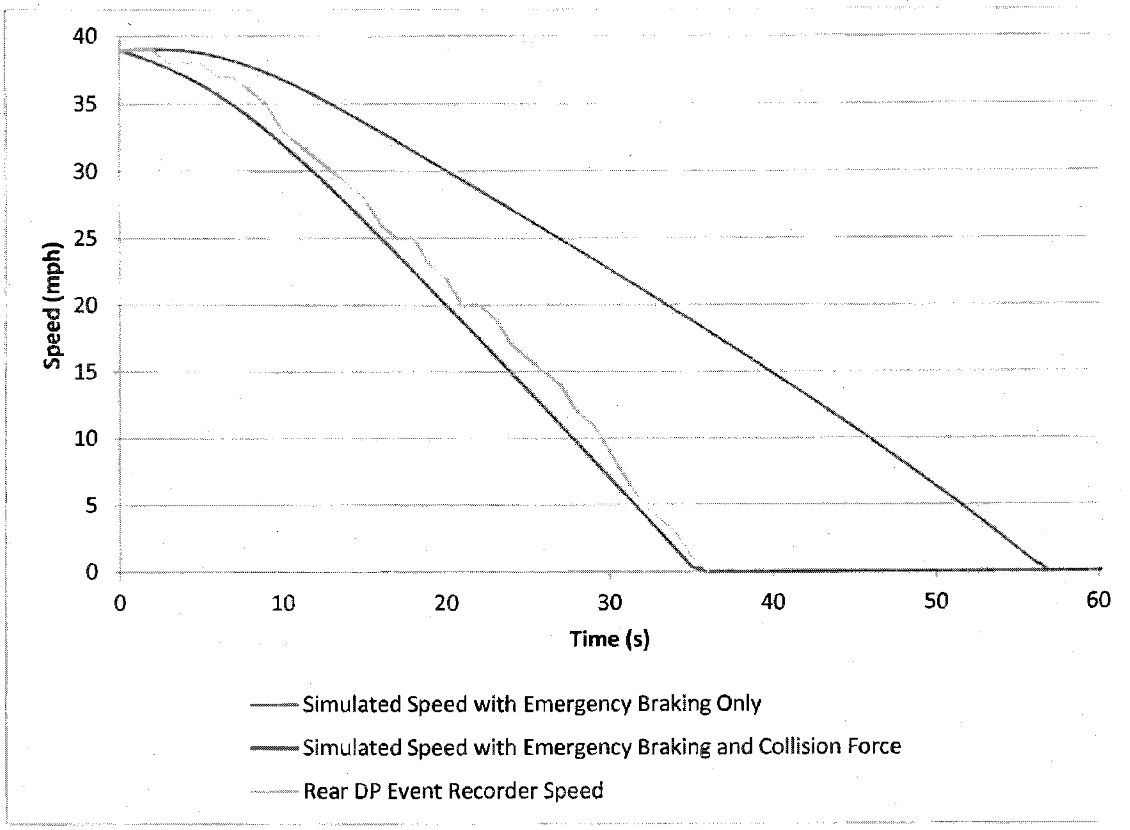

Figure 1. Comparison of Simulated and Actual Speeds for Aliceville, AL, Derailment

As Figure 1 shows, the addition of the derailment blockage force results in a very good speed match between the simulated and actual data.

The Brainerd, MN, derailment occurred more towards the center of the train and event recorder data showed the train traveling at 27 mph at the time the emergency was initiated at the rear end of the train. The train came to a stop in 22 seconds. Because the derailment occurred near the middle of the train, the simulation was run with a trainline emergency applied at the first car that derailed, which then propagated towards the rear end of the train. Only the cars trailing the point of derailment were included in the simulation. The result of the simulation showed the trailing cars of the train coming to a stop in 41 seconds. With the derailment blockage force added, the computed time for the train to come to a stop was adjusted to 22 seconds, matching the event recorder data. In this case, a 550,000-pound derailment blockage force was applied to match the stopping time from the event recorder data. Figure 2 shows the speed versus time profile from the event recorder data, the simulation with emergency braking only, and the simulation with the derailment blockage force considered for the Brainerd, MN, derailment.

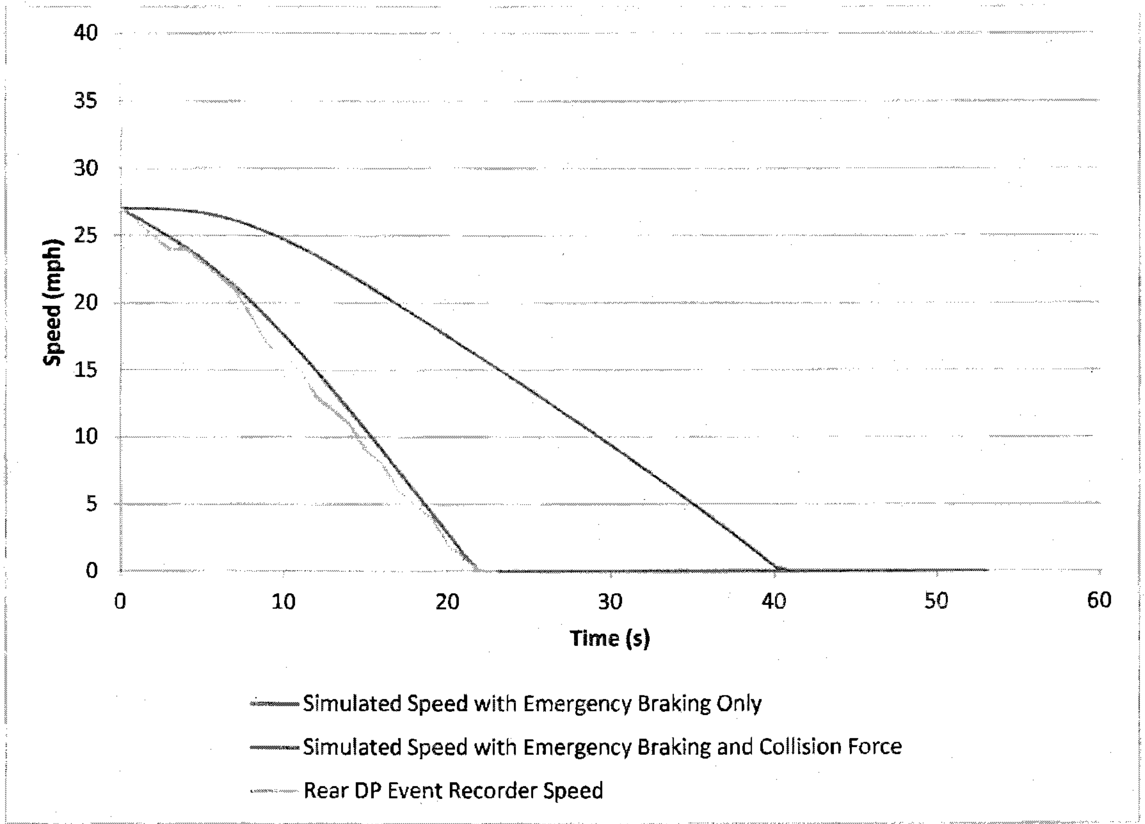

Figure 2. Comparison of Simulated and Actual Speeds for Brainerd, MN, Derailment

The Wagner, MT, derailment occurred near the end of the train. The event recorder data showed that the rear end of the train came to a stop in 11 seconds from an initial speed of 37 mph. In this case, because the derailment occurred toward the end of the train, the mass of the train trailing the point of derailment was much smaller than in the previous two cases, so the effect of the derailment blockage force on the deceleration of the rear end of the train was much greater, relative to the brake force. Again, a trainline emergency was initiated within the TOES simulation at the first car derailed, and the cars trailing the point of derailment were simulated. The simulated stopping time with the emergency brake application only was 49 seconds. A derailment blockage force of 650,000 pounds was added to align the stopping time with the event recorder data. Figure 3 shows the speed versus time profile from the event recorder data, the simulation with emergency braking only, and the simulation with the derailment blockage force considered for the Wagner, MT, derailment.

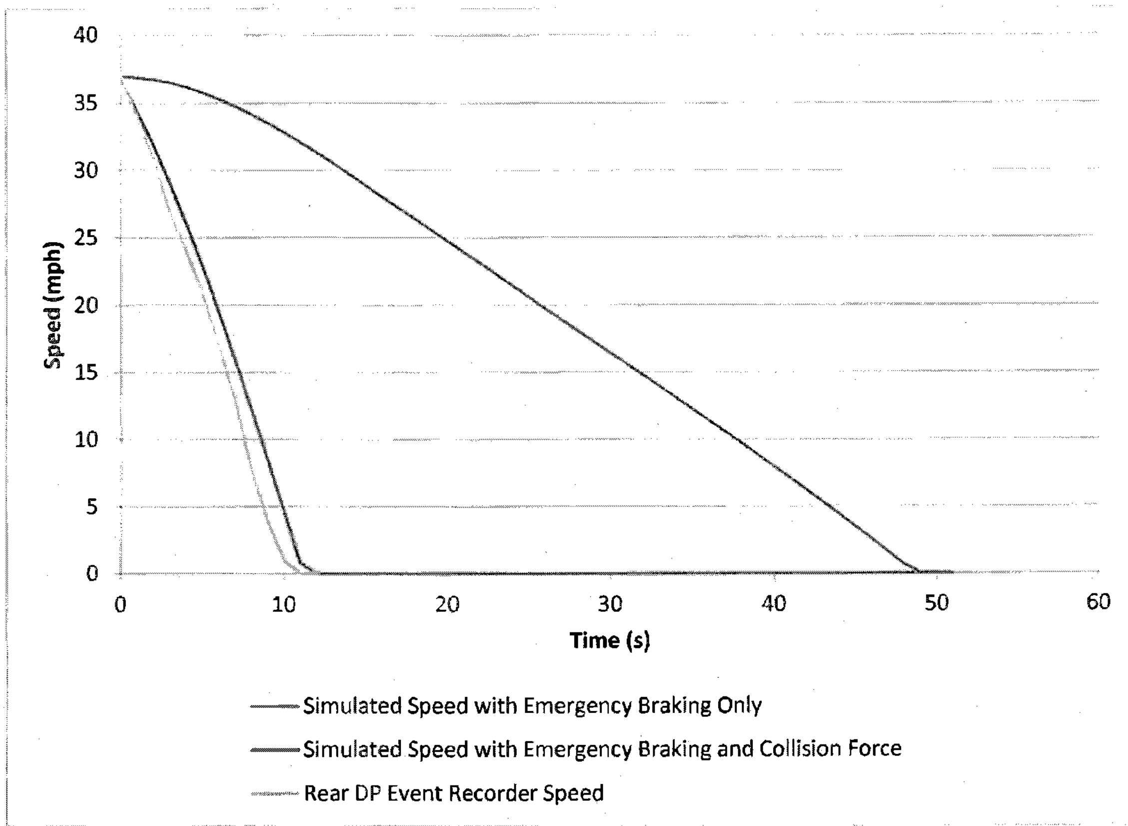

Figure 3. Comparison of Simulated and Actual Speeds for Wagner, MT, Derailment

Based on the analysis of these three derailments, it is clear that a significant amount of the energy dissipated in decelerating the portion of the train trailing the point of derailment is due to the force applied from the derailment blockage. From these cases, it can be seen that this force can vary, based on the particular accident in question, from 500,000 to 650,000 pounds. Before proceeding with applying this force to the analysis of other derailments for which remote DP event recorder data was not available, a sensitivity analysis was conducted to verify the impact of changing the derailment blockage force on the results of the analysis on alternative braking systems.

For the sensitivity study, the Aliceville, AL, derailment was considered. The simulation of the actual event, using DP located at the rear end of the train, was repeated once using conventional (head-end only) power, and again using ECP brakes. The previously determined derailment blockage force of 500,000 pounds was applied to each of these simulations, and the difference in energy dissipated in the derailment and number of cars reaching the point of derailment was determined. The derailment blockage force was then modified to 400,000 pounds and 600,000 pounds (+/- 20 percent) and the results recomputed to determine the sensitivity of the resulting analysis to this change. Table 2 shows the result of this analysis.

Table 2. Comparison of Results with Varying Derailment Blockage Force Assumptions

Blockage Force (lbs.)	Brake System	Energy Dissipated in Derailment (ft-lb)	Percent Reduction in Energy Dissipated in Derailment with ECP	Number of Cars Reaching Point of Derailment	Reduction in Number of Cars Reaching Point of Derailment with ECP
400,000	Conventional (Head-end)	182k	18%	21.7	2.8
	Rear-end DP	168k	12%	20.5	1.6
	ECP	148k	N/A	18.9	N/A
500,000	Conventional (Head-end)	165k	18%	19.9	2.5
	Rear-end DP	154k	12%	18.8	1.5
	ECP	136k	N/A	17.4	N/A
600,000	Conventional (Head-end)	151k	17%	18.4	2.3
	Rear-end DP	142k	11%	17.4	1.3
	ECP	126k	N/A	16.1	N/A

As Table 2 shows, changing the derailment blockage force had a noticeable effect on the magnitude of the energy dissipated in the derailment and the number of cars reaching the point of derailment. However, when the relative percent difference between the energy dissipated and number of cars reaching the point of derailment were considered, only a modest change is observed. Therefore, a conservative estimate of 500,000 pounds for the derailment blockage was assumed, which is a reasonable assumption for the analysis of the benefit of ECP brakes, relative to the other braking systems.

Having developed an estimate for the derailment blockage force in these types of derailments and validated it against actual event recorder data, an analysis was conducted to identify the potential benefits of alternative braking systems for some of the actual tank car derailments cited in the NPRM. Specifically, the following derailments were analyzed:

- Aliceville, AL; 11/7/2013; 39 mph; 90 loads/0 empties, 26 cars derailed (car numbers 1-26)
- Cherry Valley, IL; 6/19/2009; 78 loads/36empties, 19 cars derailed (car numbers 57-75)
- Vandergrift, PA; 2/13/2014; 112 loads/7 empties, 21 cars derailed (car numbers 67-87)

For each derailment, three simulations were performed:

1. Conventional braking – pneumatic brake signal propagating from the point of derailment only
2. DP with remote unit at the rear of the train -- pneumatic brake signal propagating initially from the point of derailment only, but also from the rear end after the signal reaches the locomotive at the head end
3. ECP – electronic brake signal applying to all vehicles simultaneously

The deceleration resulting from the 500,000-pound derailment blockage force was then added to the results of each simulation to determine the deceleration of the train in each case, per the previously established approach. The distance traveled during each time step was used to determine the number of cars that reached the point of derailment during that time step, and these were summed to determine the total number of cars that reached the point of derailment. The energy dissipated in the derailment at each time step was then determined using the mass of the cars that reached the point of derailment during that time step and the velocity of the train at that time step, using the formula $E = 1/2mV^2$. The total energy dissipated in the derailment was then determined by summing the energy dissipated in each time step over the time of the stop. The results of these calculations relative to ECP for each of the derailments are provided in Table 3.

Table 3. Percent Reduction in Energy Dissipated in Derailment and Number of Cars Reaching Point of Derailment for Actual Derailments Investigated

Derailment	Brake System	Percent Reduction in Energy Dissipated in Derailment with ECP	Reduction in Number of Cars Reaching Point of Derailment with ECP
Aliceville, AL	Conventional (Head-end)	18%	2.5
	Rear-end DP	12%	1.5
Cherry Valley, IL	Conventional (Head-end)	12%	1.1
	Rear-end DP	11%	1.0
Vandergrift, PA	Conventional (Head-end)	11%	0.9
	Rear-end DP	11%	1.0

The results shown in Table 3 indicate that, with the derailment blockage force accounted for, the reduction in energy dissipated in the derailment is far less than the 36 percent estimated in the NPRM. Additionally, the reduction in number of cars reaching the point of derailment when compared to DP was less than two cars in each case.

In the case of the Vandergrift, PA, accident, the derailment did not result in a large blockage and a compact pile of cars, as in the other two derailments. Rather, the majority of cars came to rest more or less in line, with many rolled onto their sides down a shallow embankment on the side of the track. This suggests the cars were dragged along as the train came to a stop, rather than running into each other with each car rapidly decelerating as it reached the point of derailment. Only four of the 21 cars that derailed were leaking product. The reduction in energy with alternative braking systems is much more difficult to quantify in derailments such as this. Although it seems reasonable to assume that the train may have come to a stop in less time with ECP brakes, it is impossible to predict whether this would have prevented any of the derailed cars from leaking product. It is important to note that when looking at the potential benefit of ECP brakes in reducing accident severity, there are certain types of derailments, such as the Vandergrift, PA, accident, where the benefit cannot be properly quantified. It should be recognized, therefore, that any benefit estimated from a modeling approach such as that described in this study cannot be universally applied to all potential derailments, and may be an overstatement of the overall benefit.

3.0 PARAMETRIC SIMULATIONS AND ANALYSIS

Although analysis of actual derailments provides a good basis for understanding the potential benefits of the various braking systems, it is limited in the extent it can be applied more generally to derailments under other operational conditions. To provide a more comprehensive understanding, a parametric analysis covering a number of key dimensions was conducted. A test matrix was developed with support from an industry technical advisory group. The following parameters were included in the study:

- Train speed at derailment – speeds of 30, 35, 40, 45, and 50 mph
- Point of derailment within the train – derailments occurring at the head-end, 1/4-way through the train, 1/2-way through the train, and 3/4-way through the train
- Track grade – grades of 1% uphill, 1% downhill, and flat (0%)
- Brake system – conventional (head-end), conventional with end-of-train device (ETD), rear-end DP, mid-train DP with ETD, DP at 2/3 with ETD, ECP, and ECP with rear-end wired DP

Although the range of values for the parameters selected does not cover the entire potential range of operating conditions, by selecting a range of reasonable values for each of the parameters, an understanding of the effect each has on the potential benefit of ECP brakes relative to the other braking systems can be developed. There are 420 combinations of the parameters listed. A TOES simulation was run for each combination of parameters in which an emergency brake application was initiated at the specified point of derailment within the train. The following assumptions were used in the TOES model:

- Car brake ratio: 10%
- Locomotive brake ratio: 29%
- Weight of cars: 263,000 pounds
- Weight of locomotives: 415,000 pounds
- Length of cars: 59 feet
- Length of locomotives: 73 feet
- Brake pipe pressure: 90 psi

- Emergency brake cylinder pressure: 77 psi
- Remote DP locomotive emergency brake cylinder pressure: 45 psi
- Number of cars: 100
- Number of locomotives: 3 (2 lead and 1 remote for DP cases)

In most cases, the assumptions were matched to those listed in the report on the analysis referenced in the NPRM.[2] Some of the assumptions were not listed in that report, and in these cases, reasonable assumptions were developed with the support of the railroad technical advisory group.

Using the same methodology developed and validated in the analysis of individual derailments in the first part of the study, the deceleration due to a derailment blockage force of 500,000 pounds was added to the resulting deceleration resulting from the TOES simulation for each case. From this data, the energy dissipated in the derailment and the number of cars reaching the point of derailment was determined. Finally, the reduction in energy dissipated in the derailment and number of cars reaching the point of derailment with ECP compared to each of the other braking systems was determined. Table 4 presents the average of these results for all simulations performed.

Table 4. Average Percent Reduction in Energy Dissipated in Derailment and Number of Cars Reaching Point of Derailment

Performance of ECP Brake System Compared To:	Average Percent Reduction in Energy Dissipated in Derailment	Average Reduction in Number of Cars Reaching Point of Derailment
Conventional Brakes (Head-end)	13.3%	1.6
Conventional Brakes with ETD	11.6%	1.3
Rear-end DP	12.8%	1.5
Mid-train DP	10.5%	1.2
DP at 2/3	10.8%	1.2

Table 4 indicates that the average percent reduction in energy dissipated in the derailment with ECP brakes is between 10.5 percent and 13.3 percent, which is far less than that estimated by the analysis referenced in the NPRM. Additionally, the average reduction in number of cars reaching the point of derailment is less than two cars.

- The maximum percent reduction in energy dissipated in the derailment with ECP was 25.3% for the 30 mph, 1% downhill grade, derailment at the head of the train, conventional (head end only) case.

- The maximum reduction in number of cars reaching the point of derailment with ECP was 4.1 cars for the 50 mph, 1% downhill grade, derailment at the head of the train, conventional (head end only) case.

- The minimum percent reduction in energy dissipated in the derailment with ECP was 4.9% for the 50 mph, 1% uphill grade, derailment at ¾-way through the train, DP at 2/3-way through the train case.

- The minimum reduction in number of cars reaching the point of derailment with ECP was 0.3 cars for the 30 mph, 1% uphill grade, derailment at ¾-way through the train, DP at 2/3-way through the train case.

Figure 4 shows the average percent reduction in energy dissipated in the derailment with ECP for each of the other brake systems, as a function of where in the train the derailment occurs.

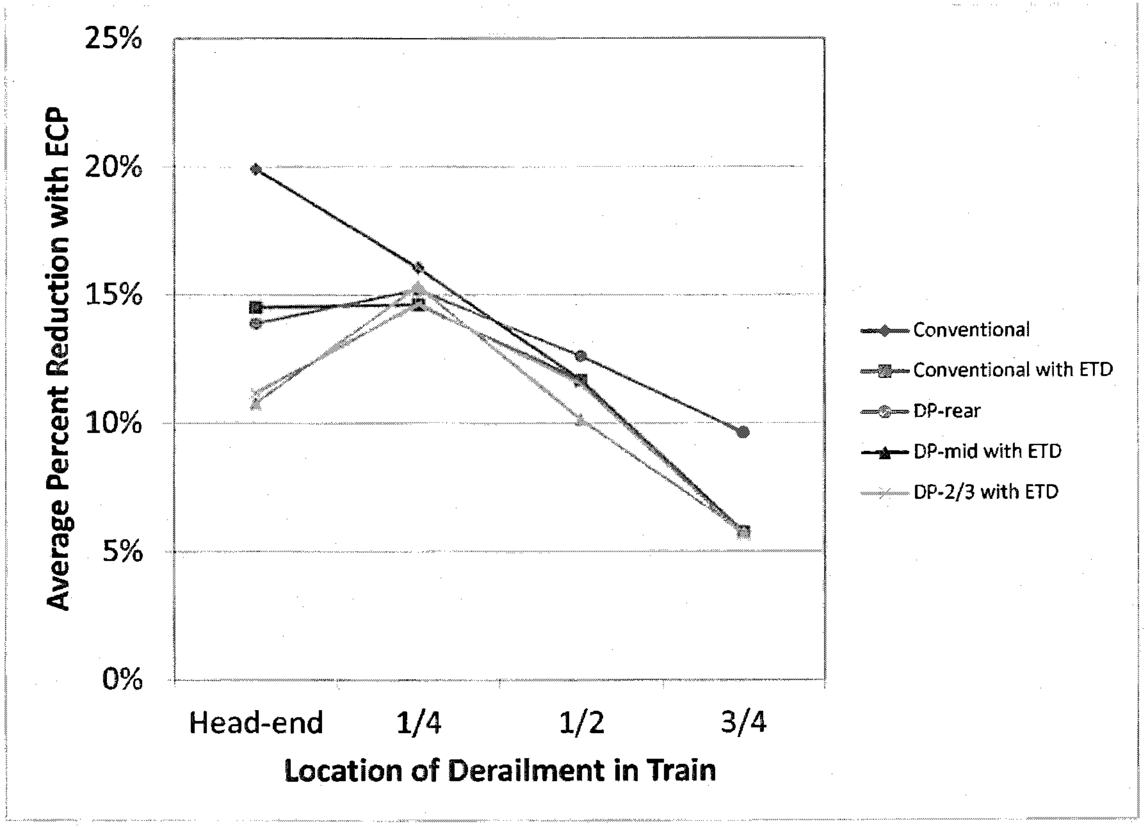

Figure 4. Average Percent Reduction in Energy Dissipated in the Derailment for ECP Compared to Other Braking Systems as a Function of Derailment Location within the Train

Figure 4 shows that the benefit of ECP relative to the other brake systems varies dramatically with where in the train the derailment occurs. In particular, the benefit of ECP relative to conventional (head end only) brakes is far better the closer to the head end of the train the derailment occurs. This illustrates the importance of considering derailments at various locations within the train in an analysis of the relative benefits of various brake systems.

4.0 CONCLUSIONS

The objective of the analysis presented in this report was to evaluate the validity of the estimate of the benefit of ECP brakes cited in the NPRM in terms of reduction in energy dissipated in a tank car derailment relative to other braking systems. The independent modeling and analysis conducted shows that the NPRM estimate that ECP brakes provide a 36 percent reduction in energy dissipated in a derailment is clearly overstated. The maximum reduction in energy dissipated with ECP compared to conventional brakes was found to be 25.3 percent and the average percent reduction in energy dissipated with ECP compared to conventional brakes was found to be 13.3 percent.

The limited analysis referenced by the NPRM failed to consider the effect of the force applied to the cars trailing the point of derailment from the derailment itself. The analysis presented here shows that this blockage force has a considerable effect on the deceleration of the cars trailing the point of derailment, limiting the potential of the braking system to provide a significant benefit. The comparison of the modeling and post-accident analysis against remote DP units from the trailing end provides a compelling validation of this effect.

Additionally, the analysis cited in the NPRM considers only derailments which occur at the head end of the train. The parametric analysis demonstrates that considering only head-end derailments overstates the potential benefits of ECP, as the benefit over conventional brakes is greatest when the derailment occurs at the head end.

It is important to note that the severity of any derailment depends on many factors, and not necessarily the rate of energy dissipation in braking. The analysis referenced by the NPRM and the analysis presented here apply only to derailments where a significant blockage force is developed by the derailment, resulting in dramatic deceleration of cars into a compact pile. In these types of pile-up derailments, there is a very high probability of puncture, product release and fire. The probability of a pile-up type of derailment is largely unrelated to the braking system employed. The energy dissipated into the pile of cars is a much greater factor than the energy dissipated by the braking system. Other derailment scenarios, such as the Vandergrift, PA, incident, do not result in this pile of cars. In these cases, while ECP brakes will help to dissipate the energy in the train faster, the severity of the accident in terms of probability of puncture or product release is related more to other random factors than to energy dissipation alone.

Based on the results of the modeling and analysis presented here, the PHMSA estimate that ECP brakes would reduce accident severity by 36 percent is overstated and misrepresents the potential benefit of implementing ECP brakes in reducing the severity of accidents involving high-hazard flammable trains.

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Attachment C

Scenario #1: PHMSA/FRA Regulatory Impact Analysis July 2014: =Cited in Text

Exhibit 1A Tank Car Cost Estimates in the RIA

Discount Rate: 7%

	Incremental Costs of Option 1 Tank Cars					Retrofit Costs											
			$5,000	$5,000		$34,433	$25,333	$0	$33,844	$0							
Addit Fuel & Maint Costs:			$256	$256		$1,019		$0	$641	$0							
						Retrofitted Number of Cars					Retrofitted Car Costs						
	Option 1 New Cars for New Demand	Option 1 New Cars to Replace Retired or Transfer	Cost of Option 1 New Cars for New ($Millions)	Cost of Option 1 New Cars for Repl. ($Millions)	Total Cost of Option 1 New Cars ($Millions)	Unjacketed for Use in U.S.	DOT111s for Transfer	Jacketed DOT111s for Transfer	Unjacketed CPC-1232s for Use in U.S.	Jacketed CPC-1232s for Transfer	Unjacketed for Use in U.S.	DOT111s for Transfer	Jacketed DOT111s for Transfer	Unjacketed CPC-1232s for Use in U.S.	Jacket CPC-1232s for Transfer	Total Retrofit Costs	Added Fuel & Maint. Costs	Total Incremental Option 1 Tank Car Costs
NPV - 7%			$187.0	$31.8	$218.8						$1,319.5	$172.6	$0.0	$662.6	$0.0	$2,154.6	$642.1	$2,874.5
Sum	43,588	7,787	$217.9	$38.9	$256.9	43,805	7,787	5,600	22,380	9,850	$1,508.3	$197.3	$0.0	$757.4	$0.0	$2,463.0	$1,305.8	$4,025.7
RIA		7,787	$217.9	$38.9			7,787	5,600	22,380	9,850						$2,538.7	$1,520.0	$4,315.6
2015	20,300		$101.5	$0.0	$101.5												$5.2	$106.7
2016	5,822	2,596	$29.1	$13.0	$42.1	14,602	2,596	1,867	7,460	3,283	$502.8	$65.8	$0.0	$252.5	$0.0	$821.0	$27.0	$890.1
2017	5,822	2,596	$29.1	$13.0	$42.1	14,602	2,596	1,867	7,460	3,283	$502.8	$65.8	$0.0	$252.5	$0.0	$821.0	$48.8	$911.9
2018	5,822	2,596	$29.1	$13.0	$42.1	14,602	2,596	1,867	7,460	3,283	$502.8	$65.8	$0.0	$252.5	$0.0	$821.0	$70.6	$933.7
2019	5,822		$29.1	$0.0	$29.1												$72.1	$101.2
2020																	$72.1	$72.1
2021																	$72.1	$72.1
2022																	$72.1	$72.1
2023																	$72.1	$72.1
2024																	$72.1	$72.1
2025																	$72.1	$72.1
2026																	$72.1	$72.1
2027																	$72.1	$72.1
2028																	$72.1	$72.1
2029																	$72.1	$72.1
2030																	$72.1	$72.1
2031																	$72.1	$72.1
2032																	$72.1	$72.1
2033																	$72.1	$72.1
2034																	$72.1	$72.1
Source:	p. 94	p. 94	p. 94	p. 94		p. 91	p. 92	p. 92	p. 92	p. 93					p.94	p 94	p. 91	
RIA pages	p.90	p.90	p. 82	p. 82		p.90	p.90	p. 91	p.90	p. 91							p. 94	
	p. 93	p. 93				p. 84	p. 81	p. 89	p. 85	p. 89								
							p. 89											

Scenario #1: PHMSA/FRA Regulatory Impact Analysis July 2014:

ECP Additional Costs:

=Cited in Text

Exhibit 18 Other Cost Estimates in the RIA

ECP Cost per Loco	$79,000
Locos w/ ECP:	900
% of Total Loco Fleet	3.71%

Trainers & Supervisors:	
Trainers:	$68,499
Per Supv.:	$7,090
#Supv.:	200
for Engr	$733,920
for Cond.	$146,784

	Engineers	Conductors	Carmen
#Empl.	4,500	4,500	
Cost/Hr	$49.97	$49.97	
Hrs/Empl	80	16	

Speed Restrictions in HTUAs Only:	
Train Delay Hr. Cost:	$500
Days/Year:	364

	Locomotive Costs ($Millions)	Training Costs ($ Millions) Supervisors	Engineers	Conductors	Carmen	Total Training	Total Non-Car ECP Costs	Total ECP Costs
RIA								$500.2
NPV - 7%	$66.4	$1.3	$16.8	$3.4	$0.0	$22.4	$88.8	$490.7
Sum	$71.1	$1.4	$18.0	$3.6	$0.0	$24.0	$95.1	$580.1
RIA	$71.1	$1.4	$18.4	$3.7	$0.0	$24.0	$95.1	
2015	$71.1	$1.4	$18.0	$3.6	$0.0	$24.0	$95.1	$155.95
2016								$135.56
2017								$135.56
2018								$135.56
2019								$17.47
2020								$0.00
2021								$0.00
2022								$0.00
2023								$0.00
2024								$0.00
2025								$0.00
2026								$0.00
2027								$0.00
2028								$0.00
2029								$0.00
2030								$0.00
2031								$0.00
2032								$0.00
2033								$0.00
2034								$0.00
Source: RIA pages	p. 154 p. 156 p. 157 p. 160	p. 157	p. 155 p. 156 p. 157	p. 155 p. 156 p. 157		p. 157	p. 157	p. 157 p. 169

	Hours of Delay per Day	Delay Cost ($Millions)		Total Costs ($Millions)
RIA		$22.9		$3,162.7
NPV - 7%		$22.9		$2,986.3
Sum	141	$25.6		$4,146.4
RIA		$25.6		$4,436.3
2015	74	$13.53		$215.3
2016	37	$6.65		$896.8
2017	30	$5.41		$917.3
2018				$933.7
2019				$101.2
2020				$72.1
2021				$72.1
2022				$72.1
2023				$72.1
2024				$72.1
2025				$72.1
2026				$72.1
2027				$72.1
2028				$72.1
2029				$72.1
2030				$72.1
2031				$72.1
2032				$72.1
2033				$72.1
2034				$72.1
Source:	pp. 142 - 146	p. 144	p. 145	p. 188

Scenario #2: Option 1 Car with Corrections Versus a Regulation-Mandated Option 3 CPC-1232 Tank Car

Exhibit 2A AAR Incremental Tank Car Cost Estimates

Discount Rate: 7%

	Option 1 New Cars for New Demand	Option 1 New Cars to Replace Retired or Transfer	Cost of Option 1 New Cars for New ($Millions)	Cost of Option 1 New Cars for Repl. ($Millions)	Total Cost of Option 1 New Cars ($Millions)	Retrofitted Number of Cars: Unjacketed for Use in U.S.	DOT111s for Transfer	Jacketed DOT111s for Transfer	Unjacketed CPC-1232s for Use in U.S.	Jacketed CPC-1232s for Transfer	Retrofitted Car Costs: Unjacketed for Use in U.S.	DOT111s for Transfer	Jacketed DOT111s for Transfer	Unjacketed CPC-1232s for Use in U.S.	Jacket CPC-1232s for Transfer	Total Retrofit Costs	Added Fuel & Maint. Costs	Total Incremental Option 1 Tank Car Costs
Incremental Costs of Option 1 Tank Cars / Retrofit Costs			$9,665	$9,665		$37,098	$25,333	$0	$36,509	$0								
Addit Fuel & Maint Costs:			$256	$256		$1,019		$0	$641	$0								
NPV - 7%			$361.5	$179.3	$540.8						$1,421.6	$161.0	$0.0	$714.8	$0.0	$2,297.4	$675.2	$3,363.0
Sum	43,588	23,237	$421.3	$224.6	$645.9	43,805	7,787	5,600	22,380	9,850	$1,625.1	$197.3	$0.0	$817.1	$0.0	$2,639.4	$1,375.0	$4,660.3
2015	20,300		$196.2	$0.0	$196.2												$5.2	$201.4
2016	5,822	0	$56.3	$0.0	$56.3	14,602			7,460		$541.7	$0.0	$0.0	$272.4	$0.0	$814.0	$26.3	$896.7
2017	5,822	15,450	$56.3	$149.3	$205.6	14,602		5,600	7,460	9,850	$541.7	$0.0	$0.0	$272.4	$0.0	$814.0	$51.5	$1,071.1
2018	5,822	7,787	$56.3	$75.3	$131.5	14,602	7,787		7,460		$541.7	$197.3	$0.0	$272.4	$0.0	$1,011.3	$74.6	$1,217.4
2019	5,822		$56.3	$0.0	$56.3												$76.1	$132.4
2020																	$76.1	$76.1
2021																	$76.1	$76.1
2022																	$76.1	$76.1
2023																	$76.1	$76.1
2024																	$76.1	$76.1
2025																	$76.1	$76.1
2026																	$76.1	$76.1
2027																	$76.1	$76.1
2028																	$76.1	$76.1
2029																	$76.1	$76.1
2030																	$76.1	$76.1
2031																	$76.1	$76.1
2032																	$76.1	$76.1
2033																	$76.1	$76.1
2034																	$76.1	$76.1

Scenario #2: Option 1 Car with Corrections Versus a Regulation-Mandated Option 3 CPC-1232 Tank Car

ECP Additional Costs:

Exhibit 2B AAR Other Cost Estimates

ECP Cost per Loco: $88,300
Locos w/ ECP: 20,000
% of Total Loco Fleet: 82.47%

Trainers & Supervisors:
Trainers: $68,499
Per Supv.: $7,090
#Supv.: 200
for Engr $733,920
for Cond. $146,784
for Carmen $733,920

	Engineers	Conductors	Carmen
#Empl.	27,143	41,015	9,849
Cost/Hr	$73.10	$62.16	$46.60
Hrs/Empl	80	16	80

Speed Restrictions in HTUAs Only
Train Delay Hr. Cost: $500
Days/Year: 364

	Locomotive Costs ($Millions)	Training Costs ($ Millions) Supervisors	Engineers	Conductors	Carmen	Total Training	Total Non-Car ECP Costs	Total ECP Costs
NPV - 7%	$1,650.5	$1.3	$148.3	$38.1	$34.3	$223.7	$1,874.2	$2,469.2
Sum	$1,766.0	$1.4	$158.7	$40.8	$36.7	$239.3	$2,005.3	$2,723.8
2015	$1,766.0	$1.4	$158.7	$40.8	$36.7	$239.34	$2,005.3	$2,123.06
2016								$144.07
2017								$233.66
2018								$189.23
2019								$33.76
2020								$0.00
2021								$0.00
2022								$0.00
2023								$0.00
2024								$0.00
2025								$0.00
2026								$0.00
2027								$0.00
2028								$0.00
2029								$0.00
2030								$0.00
2031								$0.00
2032								$0.00
2033								$0.00
2034								$0.00

	Hours of Delay per Day	Delay Cost ($Millions)	Total Costs ($Millions)
NPV - 7%		$22.9	$5,260.0
Sum	141	$25.6	$6,691.3
2015	74	$13.53	$2,220.3
2016	37	$6.65	$903.3
2017	30	$5.41	$1,076.5
2018			$1,217.4
2019			$132.4
2020			$76.1
2021			$76.1
2022			$76.1
2023			$76.1
2024			$76.1
2025			$76.1
2026			$76.1
2027			$76.1
2028			$76.1
2029			$76.1
2030			$76.1
2031			$76.1
2032			$76.1
2033			$76.1
2034			$76.1

Difference: Scenario #2 Minus Scenario #1 RIA

Exhibit 3A Difference Between RIA and AAR Tank Car Cost Estimates

Incremental Costs of Option 1 Tank Cars

Discount Rate: 7%

						Retrofit Costs												
			$4,665	$4,665		$2,665	$0	$0	$2,665	$0								
Addit Fuel & Maint Costs:			$0	$0		$0		$0	$0	$0								
						Retrofitted Number of Cars					Retrofitted Car Costs							
	Option 1 New Cars for New Demand	Option 1 New Cars to Replace Retired or Transfer	Cost of Option 1 New Cars for New ($Millions)	Cost of Option 1 New Cars for Repl. ($Millions)	Total Cost of Option 1 New Cars ($Millions)	Unjacketed for Use in U.S.	DOT111s for Transfer	Jacketed DOT111s for Transfer	Unjacketed CPC-1232s for Use in U.S.	Jacketed CPC-1232s for Transfer	Unjacketed for Use in U.S.	DOT111s for Transfer	Jacketed DOT111s for Transfer	Unjacketed CPC-1232s for Use in U.S.	Jacket CPC-1232s for Transfer	Total Retrofit Costs	Added Fuel & Maint. Costs	Total Incremental Option 1 Tank Car Costs
NPV - 7%			$174.5	$147.5	$322.0						$95.4	-$10.8	$0.0	$48.8	$0.0	$133.4	$33.1	$488.5
Sum	0	15,450	$203.3	$185.7	**$389.0**	43,805	7,787	5,600	22,380	9,850	$116.7	$0.0	$0.0	$59.6	$0.0	**$176.4**	$69.2	$634.6
2015	0		$94.7	$0.0	$94.7	0	0	0	0	0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$94.7
2016	0	-2,596	$27.2	-$13.0	$14.2	0	-2,596	-1,867	0	-3,283	$38.9	-$65.8	$0.0	$19.9	$0.0	-$7.0	-$0.7	$6.6
2017	0	12,854	$27.2	$136.3	$163.5	0	-2,596	3,733	0	6,567	$38.9	-$65.8	$0.0	$19.9	$0.0	-$7.0	$2.6	$159.2
2018	0	5,191	$27.2	$62.3	$89.4	0	5,191	-1,867	0	-3,283	$38.9	$131.5	$0.0	$19.9	$0.0	$190.3	$4.0	$283.7
2019	0		$27.2	$0.0	$27.2	0	0	0	0	0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$4.0	$31.1
2020																	$4.0	$4.0
2021																	$4.0	$4.0
2022																	$4.0	$4.0
2023																	$4.0	$4.0
2024																	$4.0	$4.0
2025																	$4.0	$4.0
2026																	$4.0	$4.0
2027																	$4.0	$4.0
2028																	$4.0	$4.0
2029																	$4.0	$4.0
2030																	$4.0	$4.0
2031																	$4.0	$4.0
2032																	$4.0	$4.0
2033																	$4.0	$4.0
2034																	$4.0	$4.0

Difference: Scenario #2 Minus Scenario #1 RIA

ECP Additional Costs:

Exhibit 3B Difference Between RIA and AAR Other Cost Estimates

						Engineers	Conductors	Carmen		
ECP Cost per Loco										
$9,300	Trainers:	$0		#Empl.		22,643	36,515	9,849	Train Delay Hr. Cost:	$0
Locos w/ ECP:	Per Supv.:	$0		Cost/Hr		$23.13	$12.19	$46.60	Days/Year:	0
19,100	#Supv.:	$0		Hrs/Empl		0	0	80		
% of Total Loco Fleet	for Engr	$0								
78.76%	for Cond.	$0	for Carmen							
			$733,920							

	Locomotive Costs ($Millions)	Training Costs ($ Millions) Supervisors	Engineers	Conductors	Carmen	Total Training	Total Non-Car ECP Costs	Total ECP Costs
NPV - 7%	$1,584.0	$0.0	$131.5	$34.8	$34.3	$201.3	$1,785.3	$1,978.5
Sum	$1,694.9	$0.0	$140.7	$37.2	$36.7	$215.4	$1,910.3	$2,143.7
2015	$1,694.9	$0.0	$140.7	$37.2	$36.7	$215.4	$1,910.3	$1,967.1
2016								$8.5
2017								$98.1
2018								$53.7
2019								$16.3
2020								$0.0
2021								$0.0
2022								$0.0
2023								$0.0
2024								$0.0
2025								$0.0
2026								$0.0
2027								$0.0
2028								$0.0
2029								$0.0
2030								$0.0
2031								$0.0
2032								$0.0
2033								$0.0
2034								$0.0

	Hours of Delay per Day	Delay Cost ($Millions)	Total Costs ($Millions)
NPV - 7%		$0.0	$2,273.8
Sum	0	$0.0	$2,544.9
2015	0	$0.0	$2,005.0
2016	0	$0.0	$6.6
2017	0	$0.0	$159.2
2018			$283.7
2019			$31.1
2020			$4.0
2021			$4.0
2022			$4.0
2023			$4.0
2024			$4.0
2025			$4.0
2026			$4.0
2027			$4.0
2028			$4.0
2029			$4.0
2030			$4.0
2031			$4.0
2032			$4.0
2033			$4.0
2034			$4.0

Attachment D

THE SECRETARY OF TRANSPORTATION
WASHINGTON DC 20590

April 9, 2014

The Honorable Edward R. Hamberger
President and Chief Executive Officer
Association of American Railroads
425 Third Street, SW
Washington, DC 20024

Dear Mr. Hamberger:

I want to thank you for the Association of American Railroads' (AAR) ongoing work and close collaboration with the U.S. Department of Transportation (DOT) to ensure the safe transport of crude oil by rail.

The AAR has been an important partner, working diligently to implement critically important safety measures, including speed restrictions, additional inspections, braking system technologies and resources for emergency responder training. Your actions have strengthened our efforts to bring immediate safety benefits to the communities situated along crude oil train routes.

I am writing now to follow up with you on an additional commitment from the Call to Action meeting I hosted earlier this year in which AAR agreed to reassemble the Rail Tank Car Standards Committee to reach consensus on additional changes proposed to the AAR rail tank car standard to be considered by DOT in the rulemaking process. In particular, I am writing to inquire about the progress of the tank car design committee.

I know you have convened the committee in the weeks since the Call to Action meeting, and I am now requesting a report on what conclusions, if any, the committee has reached. If you have been unable to reach consensus, I ask that you continue to convene the committee in an effort to do so, and in the meantime, provide me and our team with a status report updating us on the work of the committee thus far.

For our part, DOT is fully engaged in our rulemaking process for determining a new tank car standard. While the tank car design committee does not have an official role in that rulemaking process, AAR and those you have convened as members of the committee are important stakeholders in this conversation about the future of the tank car, and we would be interested to hear their views and recommendations.

Rail safety is a responsibility that we all share, and we will continue to seek a comprehensive approach to improving the safe shipment of crude oil by rail. Thank you and I look forward to your reply.

Sincerely,

Anthony R. Foxx

THE SECRETARY OF TRANSPORTATION
WASHINGTON, DC 20590

July 11, 2014

RECEIVED JUL 15 2014

The Honorable Edward R. Hamberger
President and Chief Executive Officer
Association of American Railroads
425 Third Street SW, Suite 1000
Washington, DC 20024

Dear Mr. Hamberger:

Thank you for your letter to the U.S. Department of Transportation (DOT) in which you provided an update on recent meetings of the Association of American Railroads (AAR) Rail Tank Car Committee (TCC). In your letter, you noted the request that I made in January 2014 as part of an industrywide "Call to Action." I asked that the TCC be recommissioned to reach consensus on additional changes proposed to the AAR rail tank car standard to be considered by DOT in the rulemaking process.

According to your letter, TCC has held two formal meetings and numerous informal meetings since the "Call to Action" to attempt to reach an agreement on a revised tank car design standard and a retrofit program for existing fleets, but has yet to reach consensus on either issue.

I sincerely appreciate the efforts put forth by the TCC to address my request. I am disappointed, however, that a consensus has not yet been reached on these very important issues. Accordingly, as I did in my April 9, 2014, letter to AAR, I urge TCC to continue to pursue consensus recommendations to inform the Department's tank car rulemaking initiative.

Since your letter is related to an open rulemaking proceeding, a copy of your letter and this response will be placed in the rulemaking's public docket (Docket Number PHMSA-2012-0082).

Sincerely,

Anthony R. Foxx